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FINAL REPORT

# NEW YORK STATE SUPERFUND STANDBY CONTRACT
# BABYLON PLUME TRACKING INVESTIGATION
## Town of Babylon, Suffolk County

WORK ASSIGNMENT NO. D002478-12

PREPARED FOR

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Prepared for:

**New York State**
**Department of**
**Environmental Conservation**

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Thomas C. Jorling, Commissioner

**Division of Hazardous Waste Remediation**
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PREPARED BY

ES
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Liverpool, New York

SEPTEMBER 1992
SY274.05

# NEW YORK STATE SUPERFUND
# STANDBY CONTRACT

# VOLATILE ORGANIC CONTAMINANT PLUME TRACKING INVESTIGATION IN THE VICINITY OF THE BABYLON LANDFILL, TOWN OF BABYLON, NEW YORK

PREPARED FOR:

**NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION**

PREPARED BY:

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**SEPTEMBER 1992**

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# SECTION I EXECUTIVE SUMMARY

## OBJECTIVES

This investigation of the Pinelawn Industrial Area (Pinelawn) was undertaken as a result of the discovery of volatile organic compound (VOC) contamination of groundwater in the Upper Glacial aquifer in the vicinity of the Babylon Landfill, Town of Babylon, Suffolk County, New York (Figure I-1). Previous studies have identified at least two separate VOC plumes whose source areas appear to be located within the Pinelawn Industrial Area both to the east and west of the landfill. The specific objectives of this investigation are as follows:

- Delineate groundwater VOC plumes within the Pinelawn Industrial Area, Town of Babylon, New York;
- Identify the disposal or spill sites that may have been the sources of the contaminants; and
- Identify the site land owners who may be potentially responsible parties.

The results of this investigation will be used to plan possible law enforcement actions, but not as direct evidence. The study was designed and implemented as an initial screening process to delineate areas of groundwater contamination and <u>potential</u> sources.

## SITE BACKGROUND AND HISTORY

The Pinelawn Industrial Area is a high density industrial area, encompassing approximately one-half square mile between Patton Avenue and Edison Avenue to the north and south and Wellwood Avenue and Little East Neck Road to the west and east (Figure I-2). Cemeteries and open land bound the site on the north, south and west, and a residential area lies to the east. Regional groundwater flow direction is south-southeasterly towards the south shore of Long Island (Kimmel and Braids, 1980).

The industrial area contains five sites included on the NYSDEC Inactive Hazardous Waste Site list. Three are located west of the Babylon Town Landfill, one of these is the Babylon Landfill, and one is situated to the east of the landfill. Previous investigations of these sites have documented the presence of VOCs in groundwater beneath the Pinelawn Industrial Area. Contaminant plumes have been shown to extend up to three miles downgradient of the site.

In 1948, the Pinelawn Industrial Area was zoned for residential use with the exception of a small strip of commercial property along Wellwood Avenue (Town of Babylon, 1981). By 1980, 53% of the individual parcels had been rezoned for industrial and commercial usage, including a sanitary landfill. Presently, the area is fully developed, comprised almost entirely of closely spaced lots containing light industries on the streets bordering the landfill to the east and west.

## SCOPE OF WORK

The current study was conducted by Engineering-Science, Inc. (ES) in March and April, 1992 under contract to the NYSDEC. Slotted auger sampling of groundwater was conducted at three depths within the Upper Glacial aquifer to delineate both the horizontal and vertical extent of VOC contamination. Forty five (45) borings were drilled on street rights-of-way throughout the Pinelawn Industrial Area using 4.25-inch inner diameter (ID) hollow stem augering techniques (Figure I-3). Of the 45 borings, 44 shallow samples were taken from the upper portion of the aquifer at 20 to 30 feet bgl, 17 mid-depth samples were collected at 50 to 60 feet bgl, and 32 deep samples were taken just above the clay unit at 75 to 90 feet bgl. The clay unit is a significant geologic unit marking the bottom of the Upper Glacial aquifer in the site vicinity.

## GROUNDWATER CONTAMINATION ASSESSMENT

### Geology/Hydrogeology

The southern half of Long Island, in which the site is located, consists of an outwash plain associated with the terminus of a Wisconsinan-age glacier. Stratified sand deposits containing some gravel underlie the outwash deposits. The outwash deposits beneath the Pinelawn Industrial Area are approximately 90 feet thick, and are referred to as the Upper Glacial aquifer. They consist of coarse quartz sand and some gravel. Lithology encountered included Upper Glacial sands and gravel, and a distinct clay layer, which consists of 10 to 13 feet of silty, gray clay, and was found between 83 and 92 feet below grade.

Groundwater in the study area was encountered during drilling at depths ranging from 10 to 20 feet below ground level. Flow direction based on a water table contour map constructed from the water level data was estimated to be approximately south 35° east at a gradient of 0.0017. The horizontal groundwater velocity across the site was calculated as 3.2 feet per day (ft/day), utilizing the measured gradient of .0017, a permeability of 470 ft/day, and a porosity 25% (Kimmel and Braids, 1980).

### Groundwater Analytical Results

Eight VOCs were detected in the groundwater samples collected from the site: tetrachloroethene (PCE), trichloroethene (TCE), cis and trans 1,2-dichloroethene (1,2-DCE, reported as total concentrations of both isomers), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), 1,1,1-trichloroethane (1,1,1-TCA), benzene, and toluene. A distinct difference in occurrence and distribution of these contaminants was observed between the west and east sides of the Babylon Landfill. On the west side, several compounds, notably TCE and PCE, were detected near the bottom of the Upper Glacial aquifer on the upgradient side of the study area. Concentrations ranged from 65 - 402 parts per billion ($\mu$g/l) of total chlorinated organics. The same pattern was observed throughout the deep aquifer on the west side, ranging from 33 - 367 $\mu$g/l total chlorinated organics in all areas excluding Gleam Street. With the exception of sample locations along Gleam Street, and two locations at the southern ends of Alder and Bell streets, chlorinated organics in the deep aquifer were present at all locations at concentrations greater than 50 $\mu g/l$. The highest levels of VOCs in the entire study area were detected in the deep aquifer in a zone encompassing the middle and southern parts of Gleam Street between sample locations G2-80 and G3-82.

On the east side of the Landfill (Jersey through Otis Streets), contamination was essentially limited to the shallow portion of the Upper Glacial aquifer, and no upgradient contamination was detected at any depth. Contamination was restricted to isolated "islands" separated by distinct areas with no detects.

Analysis of the data indicated six relatively distinct areas of VOC contamination, three of which were found on the western side of the Babylon Landfill, and three on the east. The primary contaminants found in each of these areas and their vertical position within the aquifer are listed below. Table I-1 provides a more detailed summary of each area, including borings located in each of these eight areas, the compounds detected, their vertical position in the aquifer, and the maximum concentration of each compound.

(1) Gleam Street/Northern Field Street - PCE, TCE, 1,2-DCE, 1,1,1-TCA in middle and deep levels (southern Gleam St.), PCE, TCE in shallow and deep samples (northern Gleam/Field Streets).

(2) Southern Alder/Bell Streets - PCE in middle and deep samples.

(3) Southern Dale Street - PCE, TCE, 1,2-DCE in shallow and middle samples.

(4) Southern Lamar/Mahan Streets - TCE, 1,2-DCE, 1,1,1-TCA in shallow and middle samples, PCE in shallow sample.

(5) Middle Lamar Street - 1,1,1-TCA in shallow level.

(6) Southern Nancy Street - PCE, TCE, 1,1-DCE, vinyl chloride in shallow level.

**Interpretation of Results**

Five factors were used in identifying potential source areas for the eight areas of contamination delineated during the course of the investigation:

- Concentration, and horizontal and vertical distribution of VOCs in the groundwater;
- Groundwater flow direction;
- Past history of hazardous waste disposal;
- Historical records searches;
- Air photo interpretations.

Six groups of properties totalling 37 lots were initially identified as potentially associated with the six areas of contamination in the Upper Glacial aquifer. During a records search of the Suffolk County Department of Health Services (SCDHS), evidence of organic solvent usage, storage, or spillage was found for four of these properties. The potential source areas are summarized below:

- Upgradient Source Area - An upgradient source area is suspected because of VOC contamination along the northernmost street, Patton Avenue, west of the landfill, and throughout the western side of the industrial area. These borings were expected to be clean because they are located at the upgradient edge of the Pinelawn Industrial Area.
- Gleam Street - Twelve lots on northern Gleam and Field streets were considered as potential source areas for the major area of contamination found on middle and southern Gleam Street. One of these lots, located at 100 Field Street is an existing Class 2 Hazardous Waste Site. In addition to the lots, the recharge basin between Field and Eads Streets, and the former lagoon near the corner of Gleam and Patton Avenue are possible sources.
- Alder/Bell Streets - The potential source area for PCE in the middle and deep portion of the aquifer in this area is limited to the two large lots on each side of Alder Street adjacent to Edison Avenue.
- Southern Dale Street - Shallow and middle aquifer contamination at southern Dale Street was attributed to six lots, two of which are existing Class 2 or 2a Hazardous Waste Sites, located at 50 and 60 Dale Street, respectively.
- Southern Lamar Street/Mahan Streets - Elevated levels of VOCs (PCE, TCE, and 1,1,1-TCA) in the shallow aquifer at the south ends of Lamar and Mahan Streets could be attributed to an area consisting of four lots, one of which is on the west side of Mahan Street, and three bordering Lamar Street.
- Mid-Lamar Street - Eight small lots were identified as potential source areas for TCA contamination of the shallow zone in the middle section of Lamar Street. One of these lots, 88 Lamar Street, was the focus of a recent hydrogeologic investigation (H2M Group, 1991) which showed the presence of 1,1,1-TCA in groundwater in excess of 1300 $\mu g/l$. Based on the analytical results, this area and the area at southern Lamar constitute separate potential source areas.
- Southern Nancy Street - Two lots, one on each side of Nancy Street bordering Edison Avenue, were selected as potential source areas for PCE, TCE, 1,1-DCE, 1,2-DCE, and vinyl chloride found at location N3. This zone appeared to be separate from the Mahan Street area because TCE was the primary contaminant found here.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

- The primary VOCs detected in the groundwater beneath the site were PCE, TCE, 1,2-DCE, 1,1-DCE, 1,1-DCA, and 1,1,1-TCA. PCE and TCE were the most prevalent compounds, especially in the deeper zone of the aquifer.
- Contamination was detected at all three depths (shallow, middle, deep) in the Upper Glacial aquifer; the deep zone contamination was limited to the

western half of the area, and shallow contamination was found in several locations throughout the study area.

- Six relatively distinct areas of contamination were found; three on the western side of the Babylon Landfill, and three on the east.
- Six groups of properties in addition to an offsite upgradient source area were identified as potential sources of the detected VOCs.
- Additional evidence of organic solvent usage/storage/spillage by a few of these properties was found through records searches. Four of the existing classified hazardous waste sites (NTU Circuits, Spectrum Finishing, US Electroplating, and West Babylon Industrial Area) are among these properties.

**Recommendations**

The objectives of the study were achieved, and the following recommendations are offered:

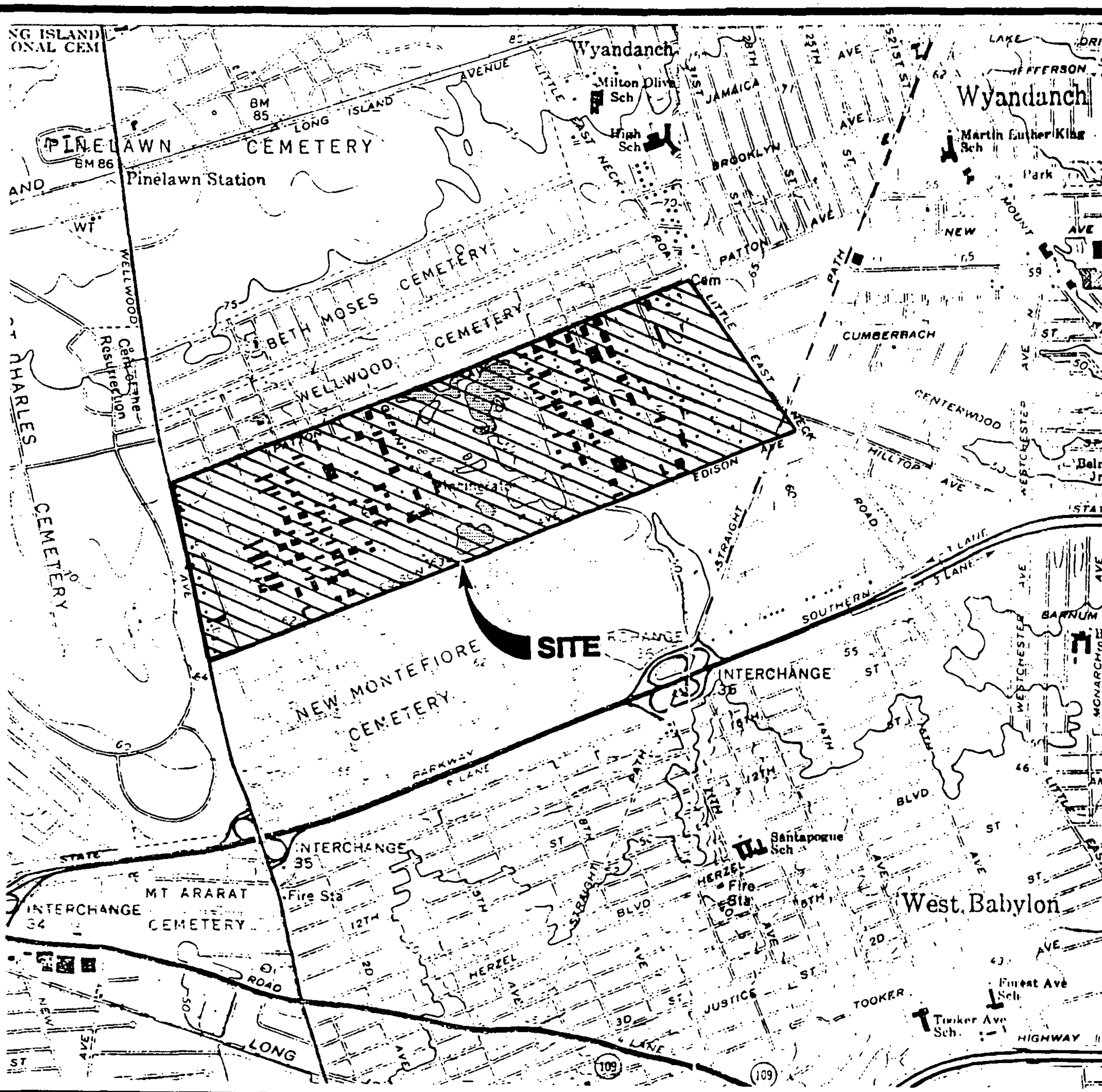
(1) The upgradient source area responsible for VOC contamination (total chlorinated organics between 50 and 220 $\mu$g/l) of the deep zone in the western half of the study area deserves further investigation. This study could require groundwater sampling in the cemeteries to the north and west of the industrial area. The commercial, industrial strip along Rte. 110 is one possible source area.

(2) Site-specific investigations should be conducted at the properties identified in Table IV-5, and Figure IV-39, particularly those having supporting evidence from the records searches and background sampling data. A more extensive file search and deed search may provide sufficient evidence to perform site-specific investigations on more of these lots.

Because of the uniform nature of the geology, soil gas surveys would be particularly applicable at this site. Probes could be driven nearly to the water table, and could provide information that would be useful in locating the source(s) of VOC groundwater contamination.

# TABLE I-1
# VOC CONTAMINATION SUMMARY

| LOCATION | BORINGS IN AREA | DEPTH | COMPOUND | MAXIMUM CONC. (µg/l) |
|---|---|---|---|---|
| WEST OF LANDFILL | | | | |
| (1) GLEAM/FIELD | FG2, G2, G2.25, G2.5, G3 | SHALLOW | PCE | 110 |
| | | SHALLOW | TCE | 19 |
| | | MIDDLE | PCE | 1300 |
| | | MIDDLE | TCE | 220 |
| | | MIDDLE | 1,2-DCE | 34 |
| | | DEEP | PCE | 4300 |
| | | DEEP | TCE | 885 |
| | | DEEP | 1,2-DCE | 175 |
| | | DEEP | 1,1-DCE | 52 |
| | | DEEP | 1,1-DCA | 34 |
| | | DEEP | 1,1,1-TCA | 360 |
| | F1,G1 | SHALLOW | PCE | 260 |
| | | SHALLOW | TCE | 120 |
| | | DEEP | PCE | 295 |
| | | DEEP | TCE | 98 |
| (2) S. ALDER/BELL | A3,B3 | DEEP | PCE | 360 |
| | | MIDDLE | TCE | 420 |
| (3) SOUTHERN DALE | D2.5, D2.75, D3 | SHALLOW | PCE | 600 |
| | | SHALLOW | TCE | 130 |
| | | SHALLOW | 1,2-DCE | 55 |
| | | SHALLOW | 1,1,1-TCA | 11 |
| | | MIDDLE | PCE | 400 |
| | | MIDDLE | TCE | 22 |
| | | MIDDLE | 1,1,1-TCA | 20 |
| | | DEEP | PCE | 75 |
| | | DEEP | TCE | 77 |
| | | DEEP | 1,1,1-TCA | 53 |
| EAST OF LANDFILL | | | | |
| (4) S. LAMAR/MAHAN | L2.5, L3 | SHALLOW | PCE | 37 |
| | | SHALLOW | TCE | 340 |
| | | SHALLOW | 1,2-DCE | 300 |
| | | SHALLOW | 1,1-DCA | 30 |
| | | SHALLOW | 1,1,1-TCA | 230 |
| | | MIDDLE | PCE | 10 |
| | | MIDDLE | TCE | 420 |
| | | DEEP | TCE | 11 |
| | M2.75, M3 | SHALLOW | PCE | 470 |
| (5) M. LAMAR | L2.25, L2.5 | SHALLOW | PCE | 12 |
| | | SHALLOW | 1,1,1-TCA | 1500 |
| | | SHALLOW | 1,1-DCE | 10 |
| | | SHALLOW | 1,1-DCA | 9 |
| (6) S. NANCY | N3 | SHALLOW | PCE | 58 |
| | | SHALLOW | TCE | 200 |
| | | SHALLOW | 1,1-DCE | 14 |
| | | SHALLOW | 1,2-DCE | 31 |
| | | SHALLOW | VINYL CHL. | 53 |




SOURCE: U.S.G.S. 7.5 MINUTE SERIES TOPOGRAPHIC MAPS AMITYVILLE AND BAY SHORE WEST, N.Y. QUADRANGLES 1969 (PHOTOREVISED 1979)

SCALE
0 2000 4000 FT.
2000 FT.


QUADRANGLE LOCATION

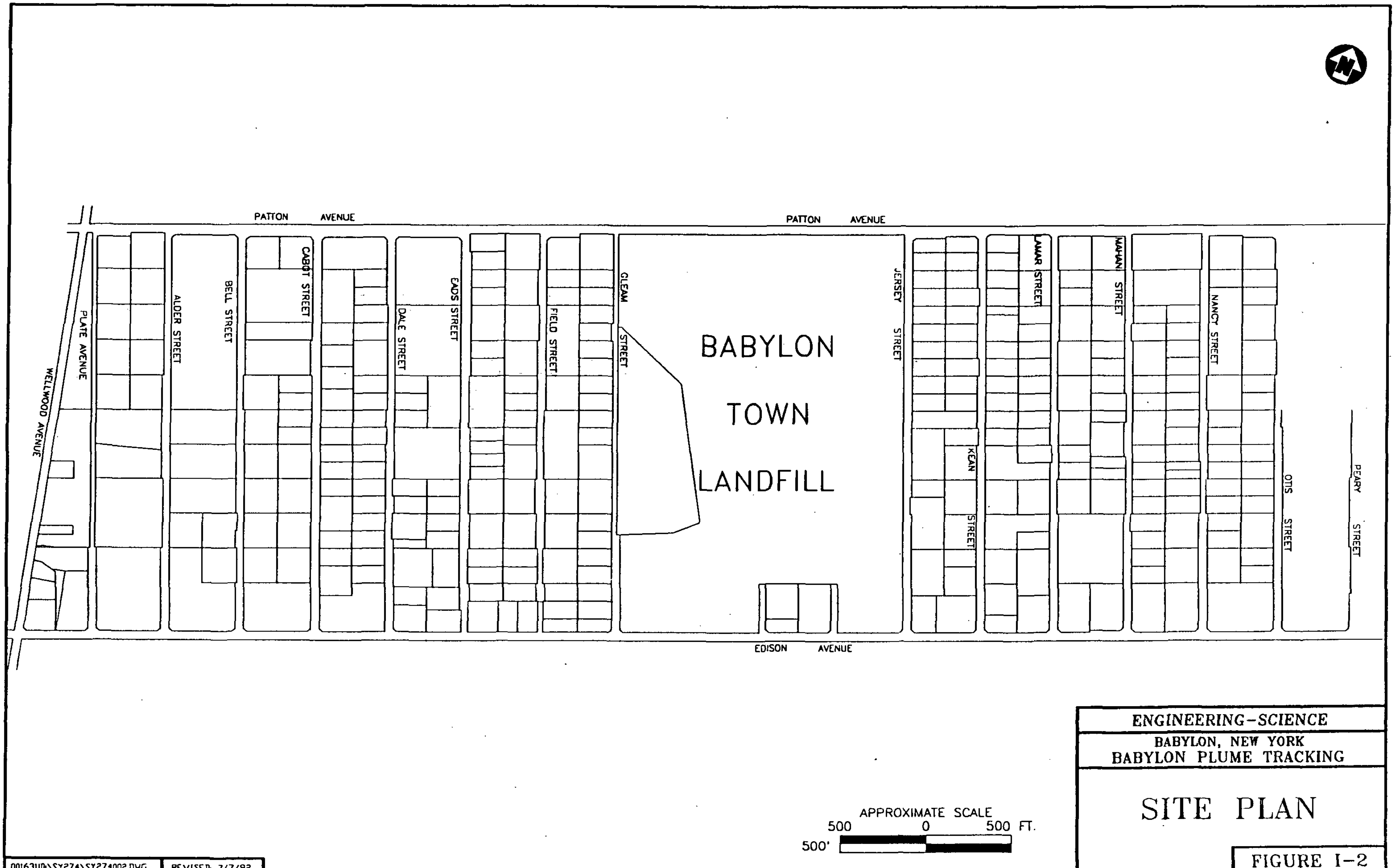
N

LATITUDE: 40°44'30"
LONGITUDE: 73°23'00"

ENGINEERING-SCIENCE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE INVESTIGATION

# SITE LOCATION
## BABYLON PLUME TRACKING
## BABYLON, N.Y.




ENGINEERING-SCIENCE

BABYLON, NEW YORK
BABYLON PLUME TRACKING

SITE PLAN

FIGURE I-2

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# SECTION II SITE BACKGROUND

## SITE DESCRIPTION

### Description

The Pinelawn Industrial Area is located in the Town of Babylon, Suffolk County, New York (Figure II-1). The site is bounded by Wellwood Avenue to the west, Little East Neck Road to the east, Patton Avenue to the north, and Edison Avenue to the south. Sixteen north-south oriented, alphabetically named streets, dissect the industrial area between Edison Avenue and Patton Avenue. Plate Avenue, Alder Street, Bell Street, and Gleam Street are not fully connected between Patton Avenue and Edison Avenue, although the tax map base used for the report depicts them as such. The Pinelawn Industrial Area is a high density industrial area, encompassing approximately one-half square mile, located on either side of the Babylon Town Landfill (Figure II-2). Cemeteries and open land bound the site on the north, south and west, and a residential area lies to the east. The various industrial uses include manufacturing, distributors, warehouses, truck terminals, a sanitary landfill, and an incinerator facility.

### History

In 1948, the Pinelawn Industrial Area was zoned for residential use with the exception of a small strip of commercial property along Wellwood Avenue (Town of Babylon, 1981). By 1960, a few areas between Gleam and Jersey Streets (present landfill site) were rezoned for industrial or commercial use. By 1970, numerous parcels between Plate and Mahan Street had been rezoned for various industrial and commercial activities, and by 1980, 53% of the individual parcels had been rezoned for industrial and commercial usage, including a sanitary landfill.

Aerial photographs of the Pinelawn Industrial Area were obtained for the years 1965, 1980, and 1990 to track the history of the area's development (Figures II-3,4,5). The 1965 photographs indicate that the entire site was largely undeveloped. The landfill, however, was in existence as early as 1955, according to air photo interpretations done by Geraghty and Miller in a 1955 report. The 1955 photo also showed an incinerator on Gleam Street, which is visible on the 1965 photo. The incinerator was destroyed in 1986 with the building of a resource recovery facility, which was put on line in 1989 (Senatore, 1992a). The streets surrounding the landfill were in existence, but contained only a few residential properties, large open areas, wooded lots, and even what appeared to be small farm or garden plots. By 1980, 75% of the area was covered by small industrial lots, and by 1990 the site was fully developed. The 1980 and 1990 photos show the emergence and terracing of the landfill, and the construction of the resource recovery facility. Presently, the site is fully developed, comprised almost entirely of closely spaced lots containing light industries on the streets bordering the landfill to the east and west. The exception is Peary Street, adjacent to Straight Path Road at the eastern end of the Pinelawn Industrial Area, which has remained almost entirely residential. Several other residences were also observed on streets to the west of the landfill during the initial site visit on January 21, 1992.

## REGIONAL SETTING

### Geography

The major landforms present on Long Island are the result of multiple geologic processes, ranging from millions of years before present to recent times. However, most of the present-day topography is related to the last ice age, the Wisconsin Stage, which ended several thousand years ago. The most prominent natural features on the island and in Suffolk County are the east-west trending lines of hills formed by terminal moraines, the gently sloping outwash plain extending southerly from the hills, the deeply eroded headlands comprising the western portion of the north shore, and the barrier beaches along the southern shore (Cohen, P., and others, 1968, USDA, 1975). Elevation in Suffolk County ranges from 400 feet at West Hills to sea level.

Average annual perception on Long Island between 1951 and 1965 was approximately 44 inches, with a maximum of 51 inches in the hills comprising the Harbor Hill Moraine in the center of the island, and a minimum of 40 inches along the coast in southern Nassau County. In general, precipitation is distributed fairly evenly throughout the year, and seasonal variations in precipitation are rather uniform throughout the island. Runoff from most housing developments and highways is discharged into recharge basins which are dug into the underlying sand and gravel deposits (USDA, 1975).

### Hydrogeology

The southern half of Long Island, in which the site is located, consists of an outwash plain associated with the terminus of a Wisconsinan-age glacier. Stratified sand deposits containing some gravel underlie the outwash deposits. The outwash deposits beneath the Pinelawn Industrial Area are approximately 90 feet thick, and are referred to as the Upper Glacial aquifer. They consist of coarse quartz sand and some gravel. Depth to groundwater ranges from between 12 to 18 feet below land surface, and has a horizontal gradient to the south-southeast of 0.0021 (Kimmel and Braids, 1980). Underlying the Upper Glacial aquifer is the Gardiners Clay, which consists of 10 to 13 feet of silty, gray clay, and occurs at depths of approximately 70 to 100 feet below land surface in the immediate site vicinity. This marine clay has been attributed to an interglacial stage, a period between two glacial advances. The major water-bearing unit below the clay unit is the Cretaceous-age Magothy aquifer, which is comprised predominantly of fine to coarse sand with interbedded lenses of clay, silt, and lignite (Callender, 1990). The Magothy is about 400 feet thick beneath much of the island.

Generalized groundwater flow paths on Long Island go in two directions from the hilly areas formed by the terminal moraines along the center of the island, northward and southward towards Long Island Sound and the Atlantic Ocean, respectively. Much of the water reaching the water table under natural conditions moves laterally through the Upper Glacial aquifer, eventually discharging into streams or major saltwater bodies. The remainder of the natural recharge volume moves vertically downward into the deeper artesian (confined) aquifers, such as the Magothy, and then laterally towards Long Island Sound and the Atlantic Ocean. The potentiometric surface map of the Magothy aquifer very much resembles the water table map of the Upper Glacial aquifer, but has generally milder gradients and fewer local disturbances (USGS, 1986).

The impact of human activities on the groundwater flow regime are substantial and complex. Some of the ways in which urbanization has altered the natural hydrologic system include changes in streamflow, groundwater pumpage, discharge of treated sewage plant effluent to the sea, recharge basins, and diffusion wells. Groundwater quality problems, including temperature changes, saltwater intrusion, and general degradation of water quality have also occurred through a period of many years of population growth and development.

**PREVIOUS INVESTIGATIONS**

There are five sites in the study area that are presently on the NYSDEC Registry of Inactive Hazardous Waste Sites. These include the Babylon Town Landfill, three sites to the west of the landfill (NTU Circuits, Spectrum Finishing, and US Electroplating), and the West Babylon Industrial Area (including Pride Solvents). A review of the files for these sites yielded the following significant information:

> Babylon Landfill Site - Task 2E of a Title 3 funded Remedial Investigation and Feasibility Study (RI/FS) conducted by the Town of Babylon between January and October, 1991 involved groundwater sampling and assessment of the site hydrogeology (Geraghty and Miller, 1992). Groundwater flow direction in the Upper Glacial Aquifer was determined to be southeasterly at a hydraulic gradient of about 0.002 feet/foot. A leachate plume attributable to the landfill was identified, but two volatile organic plumes (primarily PCE and TCE) were detected which were concluded to have sources outside the landfill, one to the east and one to the west.

> West Babylon Industrial Complex - Samples from wells at the Pride Solvents facility on Lamar Street indicated concentrations of 1,1,1 TCA in excess of 1300 $\mu$g/l, and lower levels of TCE and 1,1-DCA (27 and 35 $\mu$g/l respectively) (H2M Group, 1991).

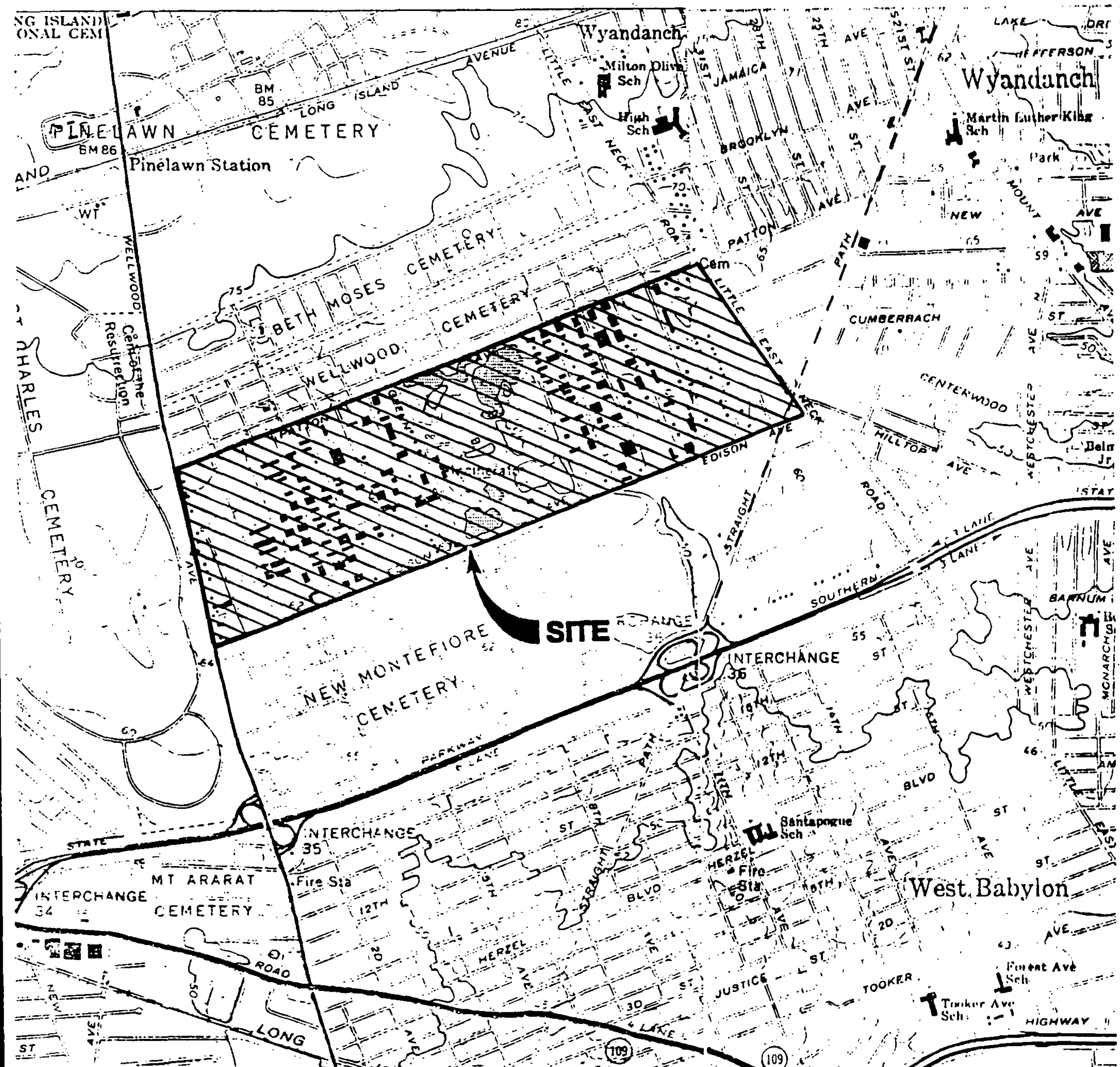
> NTU Circuits (60 Dale Street) - A NYSDEC Phase II investigation was completed in April 1992. The study was conducted on the NTU Circuits site (purchased by Spectrum Finishing in 1981), but also utilized wells from the adjacent Spectrum Finishing property (E.A. Science and Technology, 1986; Gibbs and Hill, 1992). The investigation revealed the presence of TCE (35 $\mu$g/l), PCE (370 $\mu$g/l), and 1,1,1-TCA (58 $\mu$g/l) in shallow groundwater beneath the site.

> Spectrum Finishing Corporation (50 Dale Street) - Results of shallow groundwater sampling conducted during a responsible party Phase II Investigation completed in March 1988 (GRB and Galli, R.D., 1988)

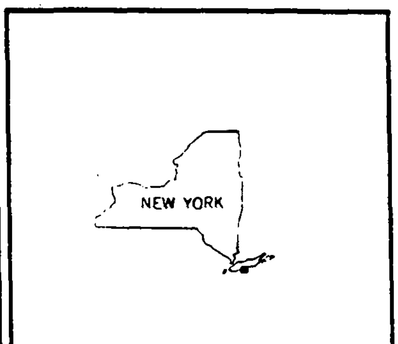
revealed 1,1,1-TCA ranging from 10 μg/l to 28 μg/l, and TCE up to 73 μg/l. The wells covered an area surrounding the Spectrum Finishing Corporation facility.

US Electroplating (100 Field Street) - Results of shallow groundwater sampling conducted during a Phase II investigation completed in April 1990 (Callender, 1990) revealed the presence of PCE at 7 μg/l, TCE at 35 μg/l, and 1,1,1-TCA at 9 μg/l.

Suffolk County Study - In 1982 and 1983, the Water Resources Bureau of the Suffolk County Department of Health Services delineated a plume of VOC contamination downgradient from the Pinelawn Industrial Area directly east of the Babylon Landfill (Robbins, S.F., 1983). The plume, which appeared to originate within the area intersected by street names beginning with J through N, was approximately 2 to 3 miles long in the southeastern direction and greater than 1000 feet wide even at the upgradient end within the Pinelawn Industrial Area. The vertical extent of contamination within the plume boundaries encompassed the area between the water table and the limits of drilling (30 to 60 below the water table). The components of the plume were primarily dense chlorinated solvents, predominantly TCE, PCE and their breakdown products, cis-1,2-DCE, 1,1-DCE, and vinyl chloride. TCA and its breakdown product 1,1-DCA were also present throughout the plume. The outline of the organic plume was shown to be distinctly separate and to the east of a previously defined leachate plume emanating from the Babylon Landfill.




SOURCE: U.S.G.S. 7.5 MINUTE SERIES TOPOGRAPHIC MAPS AMITYVILLE AND BAY SHORE WEST, N.Y. QUADRANGLES 1969 (PHOTOREVISED 1979)




QUADRANGLE LOCATION

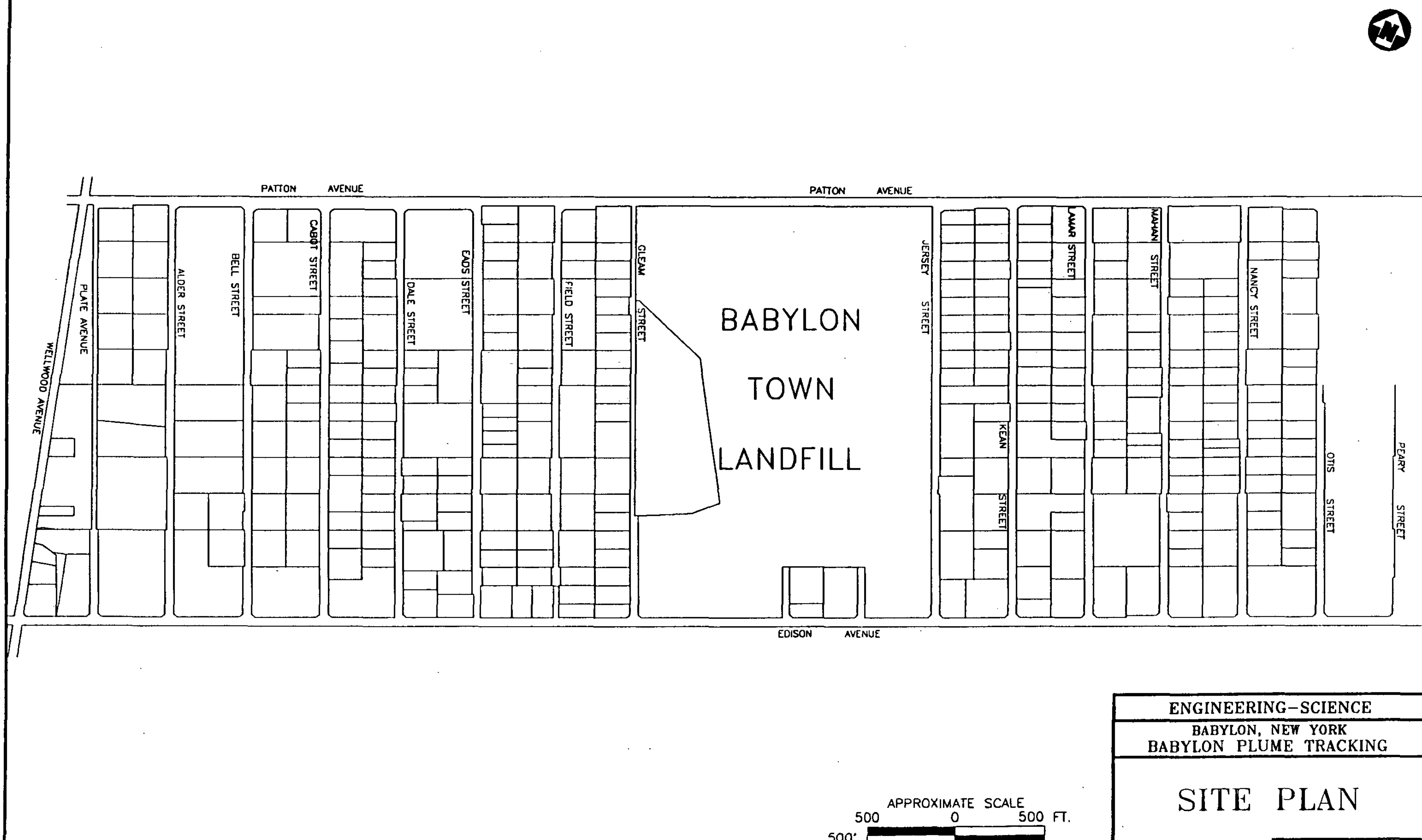
LATITUDE: 40°44'30"
LONGITUDE: 73°23'00"

SCALE
0 2000 4000 FT.
2000 FT.

ENGINEERING-SCIENCE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SITE INVESTIGATION

# SITE LOCATION
## BABYLON PLUME TRACKING
## BABYLON, N.Y.




ENGINEERING-SCIENCE

BABYLON, NEW YORK
BABYLON PLUME TRACKING

SITE PLAN

FIGURE II-2

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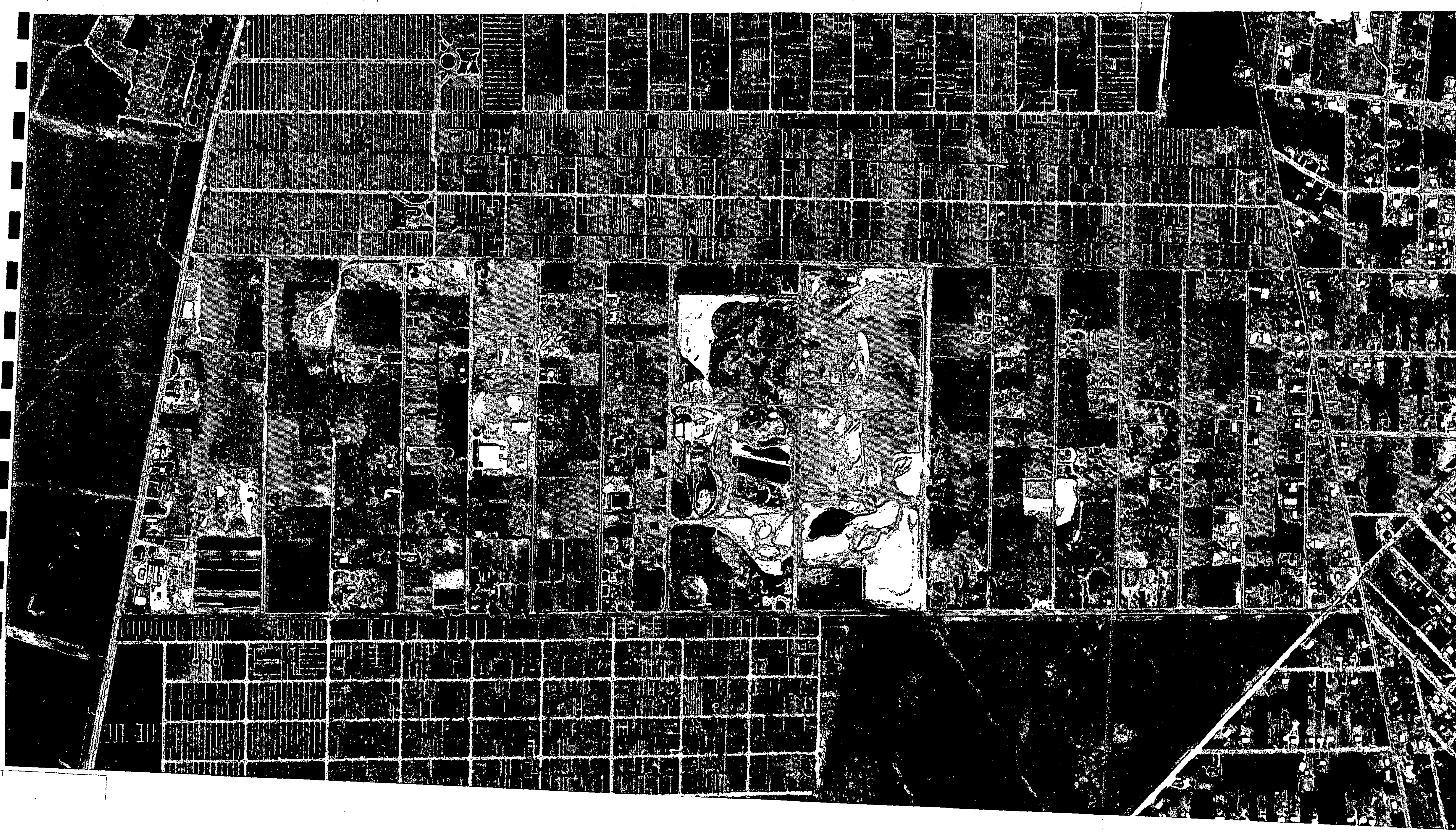
1965

FIGURE II-3



1980

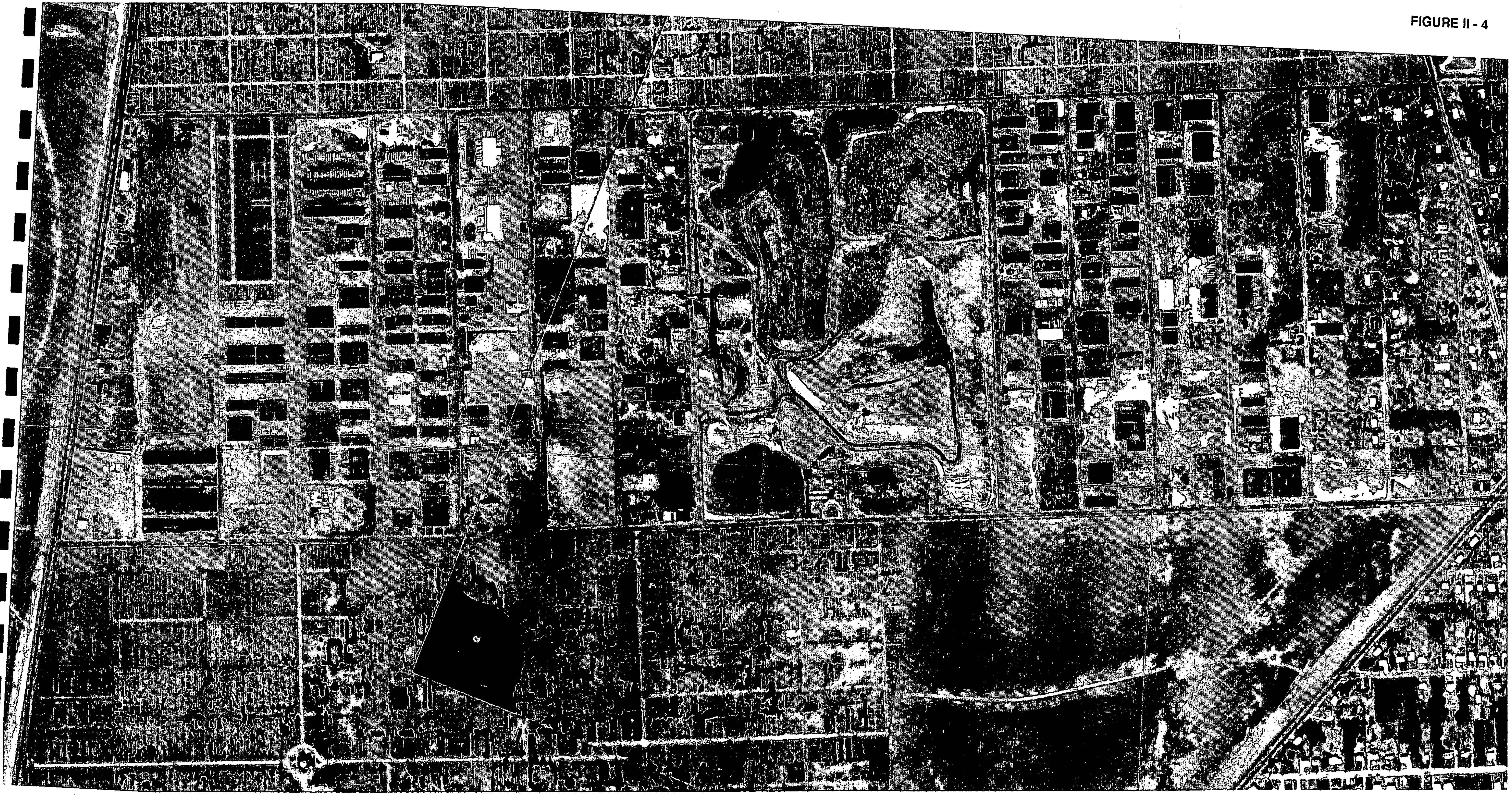


FIGURE II - 4

1990

FIGURE II - 5

# SECTION III SCOPE OF WORK

## OBJECTIVES

This investigation was undertaken as a result of the discovery of volatile organic contamination of the Upper Glacial aquifer in the vicinity of the Babylon Landfill. Previous studies have identified at least two separate VOC plumes whose source areas appear to be located in the industrial park to the east and west of the landfill. The specific objectives of this investigation are as follows:

- Delineate groundwater volatile organic contamination plumes within a defined area in the Town of Babylon, New York;
- Identify the disposal or spill sites that may have been the sources of the contaminants; and
- Identify the site land owners who may be potentially responsible parties.

The results of this investigation will be used to plan possible law enforcement actions, but not as direct evidence. The study was designed and implemented as an initial screening process to delineate areas of groundwater contamination and potential sources.

The Technical Scope of Work as originally developed by the NYSDEC and modified by Engineering-Science, Inc. with NYSDEC approval, was designed to satisfy the objectives outlined above. This section outlines the Scope of Work as executed during field activities from March 30, 1992 to April 21, 1992. Field activities were conducted in accordance with the NYSDEC-approved Work Plan dated March 1992. Any deviations from the original Work Plan were approved by NYSDEC on-site representatives prior to initiation.

## BORING LOCATION PROCEDURE

Slotted auger sampling of groundwater was conducted at three depths within the Upper Glacial aquifer to delineate both the horizontal and vertical extent of VOC contamination. Forty-five borings were drilled on street rights-of-way throughout the Pinelawn Industrial Area using 4.25-inch ID augering techniques (Figure III-3). Depth to water ranged from 10 - 20 feet below land surface, and depth to a clay unit ranged from 70 - 90 feet below ground level (bgl) Of the 45 borings, 44 shallow samples were taken from the upper portion of the aquifer at 20 - 30 feet bgl, 17 mid-depth samples were collected at 50 - 60 feet bgl, and 32 deep samples were taken just above the clay unit at 75 - 90 feet bgl. The clay unit is a significant geologic unit marking the bottom of the Upper Glacial aquifer in the site vicinity.

Boring locations and sampling depths were selected and modified based on several factors. These included (1) regularly spaced coverage of the streets surrounding the landfill, (2) site geology, (3) groundwater flow direction, (4) results of mobile laboratory analyses from previous boreholes, and (5) utilities and other restrictions, such as traffic flow considerations and manmade structures. No borings were drilled within the Babylon Landfill limits, as previous studies had indicated that the landfill was not a suspected source of the VOC contamination (Robbins, 1981, Geraghty and Miller, 1990, 1992).

Preliminary locations were laid out on a grid covering the industrial parks on both sides of the landfill (Figure III-1). The first set of the Stage 1 Array consisted of borings which were installed at the north end, south end, and mid-point (if possible) of alternate north-south trending streets from Alder Street on the west to Otis Street on the east. The distance between alternate streets is approximately 1000 feet. The second set of Stage 1 Array borings were installed more selectively at the north, south or mid-points (or a combination of the three locations) on streets not targeted in the Stage 1, first set borings. These second set boring locations were based not only on the initial grid layout, but also on mobile laboratory results of previous borings.

Stage 2 and Stage 3 borings were installed at progressively smaller spacings. Locations relied heavily on the presence or absence of contamination in previous borings. As patterns of contamination were identified, the estimated groundwater flow direction was also considered in determining the subsequent boring location. Stage 2 borings were placed midway between an upgradient (northern) "clean" Stage 1 boring and a downgradient (southern) "dirty" Stage 1 boring, resulting in a 500-foot north-south spacing. In order to further refine the source determination, Stage 3 borings were often installed halfway between a "clean" upgradient (Stage 1 or Stage 2) boring and a "dirty" downgradient Stage 1 or Stage 2) boring, resulting in a 250-foot spacing. Minor adjustments to these locations were made and additional borings were placed as necessary to fully characterize individual source areas.

Samples from both the shallow and deep portions of the aquifer were collected at most of the boring locations. In some cases, only shallow samples were taken where deep contamination was notably absent in nearby borings. Intermediate samples were collected at borings where both shallow and deep contamination were expected, and a documentation of change in concentration with depth was desired.

All samples were labelled with a unique identification consisting of the three parts: (1) the first letter of the street name on which the boring was located, (2) a number representing its relative position on the street (1 for north, 2 for center, and 3 for south), and a number representing its depth below ground surface.

## SLOTTED AUGER SAMPLING METHODOLOGY

### Boring Installation Procedures

Groundwater contamination was identified by collecting groundwater samples at various intervals through slotted hollow stem augers. A 4.25-inch inside diameter (ID), 5-foot long, stainless steel slotted auger was drilled in advance of a string of hollow stem augers. This lead auger consisted of a screened section having vertical slots with 0.01-inch openings. A plastic basket catch was placed in the base of the auger to prevent the influx of sand and silt during drilling, but allowing for split spoon sampling when necessary. Split-spoon samples were taken at each sampling depth to allow inflow of water through the bottom of augers to supplement flow through the slots.

Up to three groundwater samples were collected from each slotted auger boring. The samples were collected from five to ten feet below the water table, from 40 to 45 feet below the water table, and five to ten feet above the bottom of the aquifer. The presence of the clay layer forming the base of the Upper Glacial aquifer in the vicinity, known as the Gardiners Clay, was indicated by a noticeable increase in the resistance or torque required to advance the augers. For selected borings, the aquifer bottom was defined by either advancing the augers to the top of the clay, by split spoon sampling, or by both methods. After the first several borings, the approximate depth to clay marking the bottom of the aquifer became apparent. Most of the subsequent borings were terminated above the clay unit at depths considered representative of the lower portion of the aquifer. Occasional split-spoon samples were taken at strategic locations during the boring program to provide spatial control on depth to clay throughout the site.

**Groundwater Sampling Procedures**

Once the lead auger was advanced to the desired sampling depth, a stainless steel submersible pump was lowered into the slotted auger. A packer was inflated around the submersible pump hose immediately above the slotted auger (for intermediate and deep samples only). The inflatable packer isolated the column of water above the slotted augers, thus reducing the volume of water generated during purging, and providing for a depth-specific sample.

The augers were purged of at least three auger volumes of water prior to sampling, or until the water was sufficiently clear. A valve was attached to the end of the HDPE tubing, and the flow rate was regulated to less than two gallons per minute (GPM) to prevent excessive drawdown along the outside of the augers and siltation inside the slotted auger. Water levels inside the augers were measured during purging to insure minimal drawdown. Due to the high permeability of the Upper Glacial aquifer materials, almost no measurable drawdown occurred during purging, allowing an increase in the purge rate above two GPM when necessary.

During the initial sampling along Patton Avenue, the auger screens became clogged, resulting in lack of sufficient flow for purging and sampling. To remedy the situation, a decontaminated split spoon was driven through the basket catch attached to the lead auger at each sample depth. Opening of the basket produced substantial increases in yield, and allowed water levels inside the augers to quickly return to static conditions. This procedure was approved by the on-site NYSDEC representative prior to initiation and was utilized on all borings for the remainder of the project.

After purging 10 to 30 gallons of water from the augers, a sampling cell was assembled at the flow valve and the flow rate adjusted to approximately one GPM. While a minimum of three gallons was purged through the sampling cell, temperature, conductivity, Eh, and pH were measured utilizing a YSI Model 3560 Water Quality Monitoring System with a flow-through sample cell until stabilization of all four parameters was achieved. VOC bottles were then filled, and immediately concentration was less than 50 $\mu$g/l, the water was discharged on-site to the nearest storm drain, with NYSDEC approval.

Care was taken to minimize the volume of soil generated during auger withdrawal. The method of disposal for the drill cuttings depended on the results of groundwater analyses from that borehole. If groundwater samples were contaminated, the void left in the borehole once the augers were withdrawn was filled with a clean sand and the excess soil cuttings were placed in 55-gallon drums. The drums were staged on-site. If the groundwater was not contaminated, the borehole was backfilled with auger cuttings. Finally, the top three to five feet of the borehole was filled with a cement/bentonite grout, and completed with an asphalt or grass patch where required.

Auger cuttings from sample depths exceeding 50 $\mu$g/l total VOC contamination were containerized on-site for later sampling, analysis, and disposal by Enroserv of Long Island, Inc. in accordance with applicable state and federal regulations. Auger cuttings from sample depths with less than 50 $\mu$g/l total VOC contamination were disposed of in the staging area with NYSDEC approval.

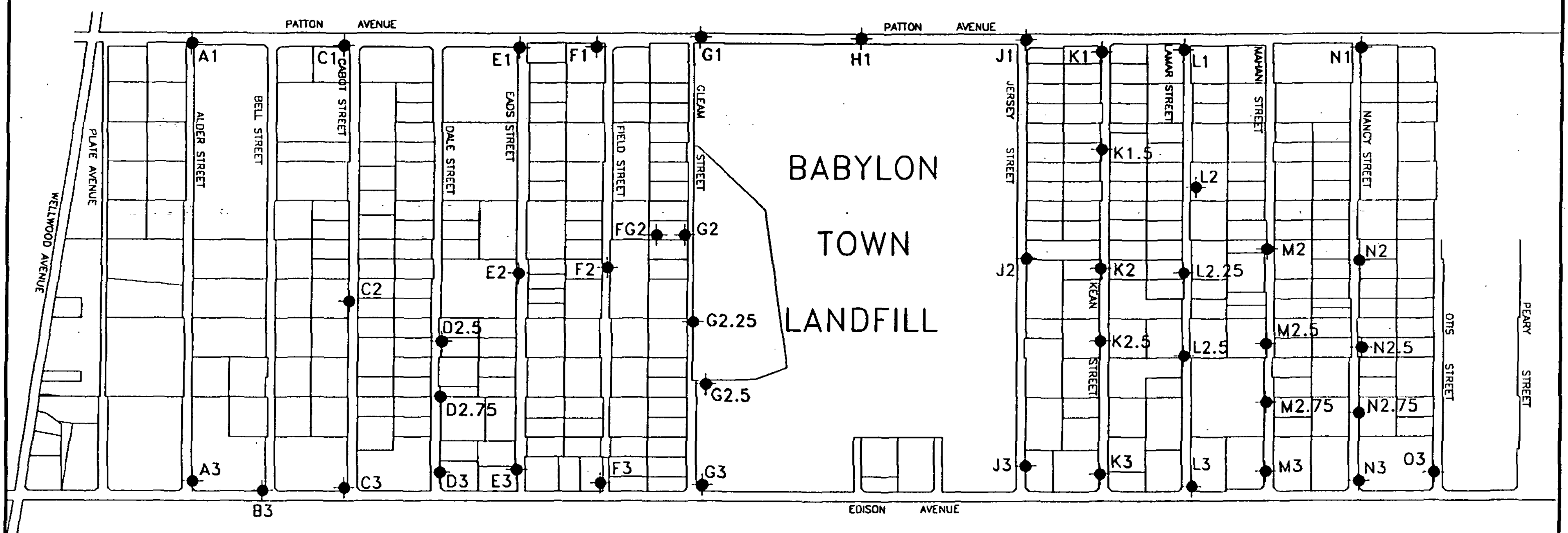
Disposable materials such as plastic sheeting, HDPE tubing, gloves, tyvek and overboots that contacted contaminated fluids or soils were containerized along with contaminated soils. Disposable materials that had not contacted contaminated fluids or soils were disposed at the Babylon Landfill facilities with approval from landfill authorities.

## SURVEYING

After completion of the groundwater sampling program, elevations and locations of each borehole were surveyed by a licensed New York State land surveyor. Elevations were surveyed to within .01-foot relative to mean sea level, using TBMs established by the Town of Babylon (USGS).

## HISTORICAL RECORDS SEARCH

A records search of the Suffolk County Department of Health Services files was conducted to generate a list of potential responsible parties (PRPs) utilizing lot numbers and street addresses in the vicinity of the contaminated areas identified from the groundwater sampling program. The search focused on identifying specific industrial properties owners in the probable source areas that had utilized or stored the specific chlorinated hydrocarbons detected in the groundwater beneath that particular area.




**LEGEND**

J3 BORING LOCATIONS

APPROXIMATE SCALE

500 0 500 FT.

500'

| ENGINEERING-SCIENCE |
|---|
| BABYLON, NEW YORK<br>BABYLON PLUME TRACKING |
| BORING<br>LOCATION MAP |
| FIGURE III-1 |

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# SECTION IV GROUNDWATER CONTAMINATION ASSESSMENT

## PHYSICAL CHARACTERISTICS OF SITE

The investigation area consists of a rectangular shaped industrial park of approximately one-half square mile in size. The park is bounded to the north and south by cemeteries, and to the east and west by Little East Neck Road and Wellwood Avenue respectively. The Town of Babylon Landfill is situated in the center of the industrial park and occupies approximately 1/4 of the park's area (Figure IV-2).

### Topography

The Babylon Town Landfill rises approximately 100 feet above the surrounding land surface, and is the most prominent topographic feature in the immediate vicinity of the study area. In the surrounding area, topography slopes gently to the southeast with a maximum elevation difference of 16 feet between Patton Avenue and Edison Avenue. Surface water on site is limited to a pond located adjacent to Edison Avenue on the Babylon Landfill property. Three recharge basins which collect storm run-off from surrounding streets are located on Bell Street, between Field and Eads Streets, and on Mahan Street (Figure IV-1). Much of the site is occupied by industrial and commercial buildings.

### Geology

A total of 45 borings were drilled at the site between March 30 and April 20, 1992 using 4.25" inner diameter (ID) hollow stem augers (Figure IV-2). Depth of borings ranged from 25 to 91 feet, with an average depth of 70 feet. Lithology encountered was simple, consisting primarily of Upper Glacial aquifer sands and gravel and the Gardiners Clay. Upper Glacial sediments were found to be generally less than 90 feet in thickness throughout the study area. The Gardiners Clay was encountered between 83 and 92 feet below grade. Table IV-1 presents a stratigraphic summary of borings installed at the site, and boring logs are included in Appendix A.

The Upper Glacial unconsolidated materials consisted primarily of tan, fine to coarse sand and fine to coarse gravel with abundant rounded, predominantly quartzitic pebbles. Traces of silt and clay were minor constituents in the lithologic section. The Gardiners Clay, can be characterized as a dense, gray clay with some gray silt. Depth to the Gardiners Clay was confirmed at nine of the boring locations through split spoon samples. This information and the survey data was utilized to make schematic geologic cross-sections of the site (Figures IV-3, IV-4, and IV-5). The elevations of the contact between the clay and the sand and gravel units were plotted on a base map of the site (Figure IV-6). The map features indicate a general dip of the clay unit to the south with a small mound in the vicinity of Gleam Street.

### Hydrogeology

Groundwater in the study area was encountered during drilling at depths ranging from 10 to 20 feet below land surface. A generalized groundwater contour map was constructed utilizing depth to water information measured in each borehole prior to sample collection and surveyed ground elevations at the borehole locations (see Figure IV-7). The accuracy of the water level measurements is considered to be within 0.5 feet because of the lack of permanent reference points (such as a casing), and the three-week time frame over which measurements were obtained. Water levels from several borings were not used in constructing the map because the accuracy was not sufficient. Not all borings were used. The approximate gradient and flow direction derived from the map are similar to the regional interpretation (Kimmel and Braids, 1980). The water level elevation across the site ranged from 48 feet above mean sea level (amsl) at Patton Avenue to 43 feet amsl in the eastern portion of Edison Avenue. Flow direction was estimated to be south 35° east at a gradient of 0.0017, which compares reasonably to 0.0021 obtained by Kimmel and Braids (1980). Foundations, storm sewer lines, recharge basins and other subsurface structures are likely to affect localized groundwater flow directions. The higher elevations on Patton Avenue at Field and Eads Streets may be due to the presence of storm sewer sumps or the recharge basin bordering Patton Avenue between Field and Eads.

Vertical hydraulic gradients were not determined because of the lack of permanent vertical reference points and limited accuracy of the measured water levels. A previous study by Geraghty and Miller (1992) indicated slight downward vertical gradients in the area. Thus, the primary flow mechanism is expected to be the difference in hydraulic heads between Patton Avenue and Edison Street, driving groundwater laterally through the saturated portion of the Upper Glacial aquifer in a south-southeasterly direction.

The relatively high permeability of the formation was evident during purging of some of the boreholes. At purge rates of 2 to 5 gpm for 10 to 15 minutes, no measurable drawdown was discerned from water level measurements.

The groundwater velocity across the site was calculated as 3.2 feet per day, utilizing the measured gradient of 0.0017, a permeability of 470 feet/day, and a porosity 25% (Kimmel and Braids, 1980).

## GROUNDWATER ANALYTICAL RESULTS

### Inorganic Parameters

The inorganic parameters, pH, Eh, conductivity and temperature, were collected at every sampling interval to supplement VOC data, and to provide information on the presence of leachate in groundwater from the nearby Babylon Landfill. Eh, or redox potential, represents the electrical potential of the groundwater solution (positive Eh indicates oxidizing reactions, negative Eh represents reducing reactions). Table IV-2 presents a complete listing of inorganic parameter results. Plots of pH, Eh, and conductivity values reported from the samples are shown in Figures IV-8 through IV-16. In general, leachate from a municipal landfill would be characterized by high conductivity, normal pH, and reducing conditions (negative Eh). Geraghty and Miller (1992) suggested that the leachate emanating from the Babylon Landfill had alkalinity values which were elevated above background levels.

Three individual sample points of high conductivity were observed in the shallow zone on Kean Street (1300 micromhos per centimeter ($\mu$mhos/cm) at K1.5) on Gleam Street (G2.5 at 505 $\mu$mhos/cm), and at the southern end of Eads Street (483 $\mu$mhos/cm). All other samples from the shallow zone fell between 100 and 300 $\mu$mhos/cm. In the deep zone, four elevated values were reported: (2750 at G2, 1250 at D2.5, 1681 at A3, and 845 at J3). No values above 400 $\mu$mhos/cm were found in the intermediate depth samples.

The pH of the Upper Glacial aquifer in the study area was slightly to moderately acidic, ranging from 4.42 at sample location G2.5-85 to a high of 6.76 at J3-80. The area with the highest pH was observed in the southern portion of Jersey and Kean Streets in the samples from the bottom of the aquifer (average of 6.75 at J2, J3, and K3). The higher pH readings in the deep zone corresponded to areas of anomalously low Eh measurements in the deep portion of the aquifer, especially at the southern end of Jersey Street (compare Figures IV-10 and IV-13), and to the elevated conductivity reading (845 $\mu$mhos/cm) at sample point J3. The correlation among these results may be indicative of leachate emanating from the eastern side of the landfill.

The Eh readings in the shallow part of the aquifer also showed two distinct lows, one near the northern end of Kean Street (K1.5) and one in the southern portion of Lamar and Nancy Streets. These areas are away from the edges of the landfill and may be related to the toluene found at K1.5 (1100 $\mu$g/l) and the chlorinated organic contamination at present at southern Lamar and Nancy Streets respectively. No obvious deviations from background Eh were observed in the middle depth samples.

Temperature of the groundwater in the Upper Glacial aquifer ranged from 12° to 17° Celsius. The average temperature in the shallow, middle, and deep portions of the aquifer was 14.7°, 15.0°, and 14.0°C respectively. No obvious patterns were observed, although a general increase in temperature from north to south could be discerned at all three levels.

**Volatile Organic Parameters**

Eight of the VOCs targeted based on previous investigations were detected in the groundwater samples collected from the site: PCE, TCE, 1,2-DCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, benzene, and toluene. A distinct difference in occurrence and distribution of these contaminants was observed between the west and east sides of the Babylon Landfill. On the west side, several compounds, notably TCE and PCE, were detected near the bottom of the Upper Glacial aquifer on the upgradient side of the study area in concentrations ranging from 65 to 402 $\mu$g/l of total chlorinated organics. This pattern was continued throughout the deep aquifer on the west side, ranging from 33 to 367 $\mu$g/l total chlorinated organics in all areas excluding Gleam Street. With the exception of sample locations along Gleam Street, and two locations at the southern ends of Alder and Bell streets, chlorinated organics in the deep aquifer were present at all locations at concentrations greater than 50 $\mu g/l$. The highest levels of VOCs in the entire study area were detected in the deep aquifer in a zone encompassing the middle and southern parts of Gleam Street between sample locations G2-80 and G3-82.

On the east side of the Landfill (Jersey through Otis Streets), contamination was essentially limited to the shallow aquifer, and no upgradient contamination was detected at any depth. Contamination was restricted to isolated "islands" separated by distinct areas with no detects.

Figures IV-17 through IV-37 are a series of maps generated from the analytical data collected during the investigation. Separate maps were prepared for each contaminant and for total VOCs for shallow, middle, and lower portions of the Upper Glacial aquifer. If a specific contaminant did not occur with great enough frequency or concentration to produce information usable in identifying its source, the data was not contoured, but simply plotted. All organic data analytical results are presented in Table IV-3.

Analysis of the groundwater data identified a maximum of six relatively distinct areas of VOC contamination, three of which were found on the western side of the Babylon Landfill, and three on the east. On the western side, the three different areas are more distinct than on the eastern side. On the eastern side, two or more of these areas in the shallow zone could be combined, particulary when considering total VOCs (Figure IV-23). However, differences in the types of contaminants found in each area suggested the possibility of multiple sources.

The primary contaminants found in each of these areas and their vertical position within the aquifer are listed below. Table IV-4 provides a more detailed summary of each area, including borings located in each of these six areas, the compounds detected, their vertical position in the aquifer, and the maximum concentration of each compound.

(1) Gleam Street/Northern Field Street - PCE, TCE, 1,2-DCE, 1,1,1-TCA in middle and deep levels (southern Gleam St.), PCE, TCE in shallow and deep samples (northern Gleam/Field Streets).

(2) Southern Alder/Bell Streets - PCE in middle and deep samples.

(3) Southern Dale Street - PCE, TCE, 1,2-DCE in shallow and middle samples.

(4) Southern Lamar/Mahan Streets - TCE, 1,2-DCE, 1,1,1-TCA in shallow and middle samples, PCE in shallow sample.

(5) Middle Lamar Street - 1,1,1-TCA in shallow level.

(6) Southern Nancy Street - PCE, TCE, 1,1-DCE, vinyl chloride in shallow level.

## INTERPRETATION OF RESULTS

### Transport Mechanisms for DNAPLS

Inherent difficulties are associated with the tracking of dense non-aqueous phase liquids (DNAPLS) in groundwater due to their chemical nature. In order to properly intepret the analytical results for chlorinated hydrocarbons obtained from the study area, it is important to have an understanding of how DNAPLS travel in the saturated zone beneath the water table. The following discussion provides a brief summary of the fate and transport of DNAPLS in groundwater, including free phase transport, dissolution, and dissolved phase movement.

When DNAPLS, in this case chlorinated hydrocarbons (CHCs) are spilled on the ground surface, they initially move downward through the vadose zone. Some of the liquid product becomes trapped in the pore space of the soil, some evaporates, and the remainder continues downward into the saturated zone. The volatile organic compounds of concern in this study are less viscous than water, causing an instability at the water table as the liquid product displaces the groundwater. The solvents will not penetrate the water table until a sufficient pressure head accumulates. As the accumulation occurs, the solvents will spread across the top of the water table, resulting in the formation of multiple fingers as they penetrate the saturated zone. Due to heterogeneities in the subsurface, the size and location of these fingers are not predictable.

Downward migration through the saturated zone continues in the case of CHCs because most chlorinated solvents are denser than water. If a layer of finer-grained material is encountered, a sufficient pressure head must again accumulate to penetrate the interface between layers. This results in additional fingers spreading laterally over a greater surface area. Downward transport of the fingers will continue until a confining layer is reached, resulting in lateral spreading and pooling of the product in depressions.

As groundwater moves past or through the fingers and above solvent pools, the CHCs will dissolve in the groundwater at a concentration below their equilibrium saturation limit and move laterally in the groundwater flow direction. Some component of vertical groundwater movement may also occur due to density differences between groundwater with dissolved CHCs and uncontaminated groundwater, and due to vertical hydraulic gradients.

The result of the transport processes of CHCs is that a single spill site may result in several individual sources of dissolved groundwater contamination where DNAPLs have pooled or become entrapped (Anderson, M.R. and others, 1991). A further complicating factor in the Pinelawn Industrial Area is that multiple spill sites may be present, each having different time periods during which releases could have occurred continuously or as slugs.

### Transformation Pathways

PCE and its breakdown product, TCE, were the most commonly detected compounds at the site, and they also had the greatest concentrations among the detected VOCs. This indicates that PCE may be the parent product because it occurs in greater concentrations than breakdown products. This fact was particularly striking on northern Gleam Street. Figure IV-38 illustrates the transformation pathways, or breakdown chains for biodegradation of selected chlorinated hydrocarbons (Dragun, 1988). PCE and 1,1,1-TCA are at the top of the chain, and biodegrade to TCE, DCE, DCA, vinyl chloride, and eventually chloroethane. In the deep aquifer beneath Gleam Street near sample locations G2, FG2, and G2.25, PCE was detected at 4300 $\mu$g/l, TCE at 885, 1,2 and 1,1-DCE at 175 and 52 $\mu$g/l respectively, and 1,1-DCA at 34 $\mu$g/l. 1,1,1-TCA, which is not a breakdown product, occurred at a concentration less than that of TCE (360 $\mu$g/l), but greater than all the other breakdown products. Thus, it is possbile that the dichloroethenes and 1,1-DCA detected in the groundwater in the area are degraded from either PCE, TCE, or 1,1,1-TCA, rather than being derived directly from a spill. Vinyl chloride was only detected at one location (N3 at 57 $\mu$g/l); its formation is the third step in the transformation pathway. A further indication of limited biodegradation in the sand and gravel aquifer is given by the presence of PCE and TCE along with the breakdown products at a distance of several thousand feet downgradient from the Pinelawn Industrial Area (Geraghty and Miller, 1992, Robbins, 1980).

**Potential Sources of Organic Plumes**

The following discussion presents potential sources for the six areas affected by VOC contamination discussed in the results section. Because of the proximity of some of the individual affected areas, only six source areas within the limits of Pinelawn were delineated. In addition, an upgradient source area is probable. The following factors were used to determine the approximate limits of the seven areas:

- **VOC results** - All VOC data were plotted on a base map containing lot boundaries. Patterns of organic contamination in all three zones of the Upper Glacial aquifer were then defined.
- **Groundwater flow direction**
- **Past history of hazardous waste disposal** - If a property within or upgradient of a contaminated zone was a listed site which had previously documented groundwater contamination with compounds of concern, this property was given consideration as a potential source area.
- **Records search information** - A records search of the Suffolk County Department of Health Services files was conducted to generate a list of potential responsible parties (PRPs). An initial list of 38 lots was selected from the Suffolk County tax map based on the contaminated areas identified from the groundwater sampling program. The search focused on identifying specific industrial properties owners in the probable source areas that had utilized or stored the specific chlorinated hydrocarbons detected in the groundwater beneath that particular area.

  Any pertinent information collected during the historical records search for a particular property was utilized in determining whether the property was a potential source area. This information, obtained from the Suffolk County

Department of Health Services, consisted mainly of documented use, storage, or disposal of compounds of interest.

- **Air photo interpretations** - Any obvious areas of potential waste disposal identified in air photos and maps of the site were interpreted as potential sources if they corresponded to zones of identified VOC contamination.

Using the VOC data and groundwater flow direction information, the 38 lots initially selected were assigned to one of the six zones of contamination described previously (see Table IV-5 for tax map lot and block numbers with corresponding street addresses). Figure IV-39 shows these groups of lots as six potential source areas for the six contamination zones previously discussed. A records search of Suffolk County Department of Health Services files was conducted in an attempt to provide confirmatory evidence for the selected lots. The records search provided evidence of organic solvent storage, usage, or leakage on four properties (SCDHS, 1982, 1983, 1984, 1985, 1988, 1992). These properties, along with the four existing NYSDEC hazardous waste sites (excluding the Babylon Landfill), are highlighted on Table IV-5 and Figure IV-39. A brief summary of the evidence implicating solvent usage, storage, or spillage from all these sites is given in the table.

In addition to the data described previously, an air photo study spanning several years conducted by SCDHS during the 1980's mapped four potential dump sites in the western half of the Pinelawn Industrial Area. Two of these areas corresponded roughly to areas of VOC contamination near the intersections of Edison and Plate Avenues, and Patton Avenue and Field Street, respectively (see Figure IV-39). Specific lots could not be identified, however, because of the generalized locations of these dumping sites portrayed on the referenced map. The 1965 air photo (Figure II-3) showed an area of exposed ground on the lot at the corner of Wellwood and Edison Avenues. By 1980 (Figure II-4), the area appeared to have been paved over.

**Upgradient Source Area**

Because of VOC contamination in the deep portion of the aquifer along Patton Avenue west of the landfill, and throughout the western side of the study area, an upgradient source area is suspected. The extensive cemeteries bordering the industrial park to the north and west suggest that the upgradient source areas are somewhat distant, perhaps 2 - 3 miles to the northwest. Migration of organic plumes in the area with limited hydrodynamic dispersion and biodegradation has been suggested by previous studies in the immediate vicinity of the Babylon Landfill (Robbins, 1980; Geraghty and Miller,1990, 1992). This does not, however, rule out the possiblity of the adjacent cemeteries as sources.

**(1) Gleam Street**

Possible source areas for the major area of contamination found on southern Gleam Street and northern Gleam and Field Streets (see Figures IV-17 through IV-23) consist of a group of properties located along the northern portions of Gleam and Field Streets (see Table IV-5 and Figure IV-39). In addition to the lots containing industrial or commercial facilities, two other possible sources of VOC contamination were found in this area. A recharge basin located between Field and Gleam Streets on the south side of Patton Avenue could account for the elevated levels of organics (primarily PCE) found in the shallow and mid-depth part of the aquifers, particularly at locations F1 and G1. A former lagoon which existed near the southeast corner of Gleam and Patton Avenue might be the source of TCE which occurred at 120 $\mu g/l$ at location G1 in the shallow zone. This lagoon appears on the 1980 air photos of the site, but did not appear in the 1990 photograph (Figures II-4 and II-5). The lagoon was reportedly created by groundwater inflow as a result of sand mining, and subsequently filled with general refuse (Senatore, 1992b).

**(2) Alder/Bell Streets**

PCE was detected above background levels in the middle and deep parts of the aquifer at southern Alder and Bell streets (420 $\mu g/l$ at A3-55). The source of this contamination may be nearby, such as the recharge basin on Bell Street or the potential dumping site identified in the air photo study near Edison Avenue and Plate Street. However, because the concentrations of PCE here were less than an order of magnitude greater than background levels in the deep zone (i.e., 220 $\mu g/l$ at A1-80), the source could also be upgradient of the industrial area.

**(3) Southern Dale Street**

Shallow and middle aquifer contamination in a small section of southern Dale Street was attributed to six lots as shown in Figure IV-39. Non-detects were recorded at many of the nearby adjacent sampling locations, such as C2, C3, E2, E3, making it possible to limit the estimated areal extent of the source. Concentrations of VOCs decreased markedly with increasing depth between the shallow and deep zones of the aquifer in this area, providing further evidence of a local source. Two existing Hazardous Waste Sites, located at 50 and 60 Dale Street, respectively, are included in this group of lots. Phase II investigations on each of these lots revealed the presence of organic contaminants in shallow groundwater (TCE, PCE, and TCA).

**(4) Southern Lamar Street/Mahan Streets**

Elevated levels of VOCs in the shallow aquifer in two small areas located at the south ends of Lamar and Mahan Streets could be attributed to an area consisting of five lots, two of which are on the west side of Mahan Street, and three bordering Lamar Street. The two lots on Mahan Street are the likely sources for PCE found at M2.75, whereas the three lots on Lamar are possible sources for the combination of solvents (primarily PCE, TCE, and 1,1,1-TCA found at location L3). It should be noted here that at location M3, at a depth of 27 feet, a visible sheen and a hydrocarbon odor was observed in soil from a split spoon sample and on the surface of the purge water during pumping. Analytical results from sample M3-27, however, did not show the presence of any petroleum hydrocarbons.

**(5) Mid-Lamar Street**

Eight small lots were identified as potential source areas for a small area of high TCA contamination of the shallow zone (up to 1500 $\mu g/l$) in the middle section of Lamar Street. One of these properties, 68-88 Lamar Street, was the focus of a recent hydrogeologic investigation (H2M Group, 1991) which showed the presence of 1,1,1-TCA in groundwater in excess of 1300 $\mu g/l$. Based on the analytical results, this area and the area at southern Lamar constitute potentially separate source areas.

**(6) Southern Nancy Street**

A relatively small portion of the shallow aquifer at the southern end of Nancy Street was contaminated with multiple organic compounds, including PCE, TCE, 1,1-DCE and 1,2-DCE, and vinyl chloride. This zone appeared to be separate from the Mahan Street area because TCE was the primary contaminant found here at levels greater than 10 times those in adjacent borings. Three lots, one on each side of Nancy Street bordering Edison Avenue, and one on the east side of Mahan Street at Edison, were identified as potential source areas for the VOCs detected at location N3.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

An extensive groundwater sampling program was conducted on the Upper Glacial aquifer in the vicinity of the Pinelawn Industrial Area, West Babylon, New York. Upon reduction, evaluation, and interpretation of the analytical results, and integration with hydrogeological data, the following conclusions were generated:

- The primary VOCs detected in the groundwater beneath the site were PCE, TCE, 1,2-DCE, 1,1-DCE, 1,1-DCA, and 1,1,1-TCA. PCE and TCE were the most prevalent compounds, especially in the deeper zone of the aquifer.
- Contamination was found at all three levels (shallow, middle, deep) in the Upper Glacial aquifer; the deep contamination was limited to the western half of the area, and shallow contamination was found at various points throughout the study area.
- Six distinct areas affected by VOC contamination were found; three on the western side of the Babylon Landfill, and three on the east.
- Six groups of properties in addition to an offsite upgradient source area were identified as potential sources for the detected VOCs.
- Additional evidence of organic solvent usage/storage/spillage by a few of these properties was found through records searches. Four of the existing Class 2 or 2a sites (NTU Circuits, Spectrum Finishing, US Electroplating, and West Babylon Industrial Area) are among these properties.

### Recommendations

The primary objectives of the study were to (1) delineate VOC plumes within the Pinelawn Industrial Area and (2) identify disposal or spill sites that may have been the sources of the contaminants. These two objectives were achieved by implementation of the groundwater sampling plan and subsequent data analysis. A third objective stated in the NYSDEC Work Assignment, to identify site land owners who might be potentially responsible parties, was only partially met. During the records search task, it was discovered that the SCHSD database was keyed to facility names, not owners. Thus, with the consent of the NYSDEC project manager, the deed search, which would yield property owners names, was eliminated from the scope of work. However, specific properties that are potential source areas, with tax map lot and block numbers, street addresses, and in some cases, present facility and owners names, were identified.

Based on the five conclusions listed previously, the following recommendations are offered:

(1) The upgradient source area responsible for VOC contamination (total chlorinated organics between 50 and 220 $\mu g/l$) of the deep zone in the western half of the study area requires further investigation. This study is likely to require monitoring wells in the cemeteries to the north and west of the industrial area. The commercial, industrial strip along Rte. 110 is one possible source area.

(2) Site-specific investigations should be conducted at the the properties identified in Table IV-38, particularly those having supporting evidence from the records searches and background sampling data. A more extensive file search and deed search may provide sufficient evidence to perform site-specific investigations on more of these lots.

Because of the uniform nature of the geology, soil gas surveys would be particularly applicable at this site. Probes could be driven nearly to the water table, and could provide information that would be useful in locating the source(s) of VOC groundwater contamination.

# TABLE IV-1

## STRATIGRAPHIC SUMMARY

| Boring | Date Drilled | Total depths (feet) below grade | Sample depths (feet) below grade | Lithology Encountered |
|---|---|---|---|---|
| Al | 4/3/92 | 80 | 35,80 | Sand, gravel (0-80) |
| A3 | 4/14/92 | 85 | 55,80 | Sand, gravel (0-87) clay (87+) |
| B3 | 4/14/92 | 80 | 30,55,80 | Sand, gravel (0-80) |
| C1 | 4/2/92 | 79 | 37,79 | Sand, gravel (0-79) |
| C2 | 4/8/92 | 91 | 30,80 | Sand, gravel (0-91) Clay (91+) |
| C3 | 4/8/92 | 85 | 30,85 | Sand, gravel (0-85) |
| D2.5 | 4/15/92 | 85 | 30,55,85 | Sand, gravel (0-85) |
| D2.75 | 4/17/92 | 85 | 30,55,85 | Sand, gravel (0-85) |
| D3 | 4/13/92 | 83 | 27,52,83 | Sand, gravel (0-83) |
| E1 | 4/2/92 | 82 | 35,80 | Sand, gravel (0-81.5) Clay (81.5+) |
| E2 | 4/7/92 | 80 | 30,80 | Sand, gravel (0-80) |
| E3 | 4/13/92 | 92 | 25,55,80 | Sand, gravel (0-92) Clay (92+) |
| F1 | 4/6/92 | 80 | 30,55,80 | Sand, gravel (0-80) |
| F2 | 4/16/92 | 81 | 30,55,81 | Sand, gravel (0-81) |
| F3 | 4/13/92 | 80 | 25,55,80 | Sand, gravel (0-80) |
| G1 | 4/1/92 | 89 | 35,89 | Sand, gravel (0-91) Clay (91+) |
| G2 | 4/6/92 | 85 | 30,85 | Sand, gravel (0-85) Clay (85+) |
| G2.25 | 4/16/92 | 85 | 30,55,85 | Sand, gravel (0-85) Clay (85+) |
| G2.5 | 4/15/92 | 85 | 30,55,85 | Sand, gravel (0-85) |
| FG2 | 4/20/92 | 80 | 23,53,78 | Sand, gravel (0-78) Clay (80+) |
| G3 | 4/13/92 | 82 | 30,55,82 | Sand, gravel (0-82) |

## TABLE IV-1-CONTINUED

## STRATIGRAPHIC SUMMARY

| Boring | Date Drilled | Total depths (feet) below grade | Sample depths (feet) below grade | Lithology Encountered |
|---|---|---|---|---|
| H1 | 4/17/92 | 83 | 25,80 | Sand, gravel (0-83)<br>Clay (83+) |
| J1 | 4/1/92 | 60 | 32,60 | Sand, gravel (0-60) |
| J2 | 4/7/92 | 91 | 32,87 | Sand, gravel (0-91)<br>Clay (91+) |
| J3 | 4/10/92 | 80 | 25,80 | Sand, gravel (0-80) |
| K1 | 4/16/92 | 25 | 25 | Sand, gravel (0-25) |
| K1.5 | 4/16/92 | 25 | 25 | Sand, gravel (0-25) |
| K2 | 4/15/92 | 25 | 25 | Fill (0-4)<br>Sand, gravel (4-25) |
| K2.5 | 4/15/92 | 25 | 25 | Sand, gravel (0-25) |
| K3 | 4/10/92 | 82 | 25,82 | Sand, gravel (0-82) |
| L1 | 4/3/92 | 77 | 25,77 | Sand, gravel (0-77) |
| L2 | 4/8/92 | 81 | 27,78 | Sand, gravel (0-80)<br>Clay (81+) |
| L2.25 | 4/15/92 | 25 | 25 | Sand, gravel (0-25) |
| L2.5 | 4/14/92 | 57 | 27,57 | Sand, gravel (0-57) |
| L3 | 4/10/92 | 80 | 25,55,80 | Sand, gravel (0-80) |
| M2 | 4/20/92 | 25 | 25 | Sand, gravel (0-25) |
| M2.5 | 4/14/92 | 27 | 27 | Sand, gravel (0-27) |
| M2.75 | 4/16/92 | 25 | 25 | Sand, gravel (0-25) |
| M3 | 4/9/92 | 80 | 27,52,80 | Sand, gravel (0-80) |
| N1 | 4/6/92 | 90 | 32,87 | Sand, gravel (0-87)<br>Clay (87+) |
| N2 | 4/8/92 | 91 | 27,89 | Sand, gravel (0-91) |
| N2.5 | 4/15/92 | 25 | 25 | Sand, gravel (0-25) |
| N2.75 | 4/16/92 | 25 | 25 | Sand, gravel (0-25) |
| N3 | 4/8/92 | 89 | 25,80 | Sand, gravel (0-88)<br>Clay (88+) |
| O3 | 4/9/92 | 83 | 27,83 | Sand, gravel (0-83) |

# TABLE IV-2
# INORGANIC PARAMETER FIELD TESTING RESULTS
# BABYLON PLUME TRACKING INVESTIGATION, BABYLON, NY

| SAMPLE INTERVAL | TIME (24-hour) | DATE | TEMP. (°C) | pH (pH units) | eH (millivolts) | COND. (micromhos/cm) |
|---|---|---|---|---|---|---|
| A1-35 | 15:52 | 4/2/92 | 14.2 | 5.21 | 188 | 170 |
| A1-80 | 9:11 | 4/3/92 | 12.7 | 5.52 | 151 | 149 |
| A3-55 | 13:39 | 4/14/92 | 14.8 | 5.38 | 147 | 420 |
| A3-85 | 14:50 | 4/14/92 | 14.3 | 5.5 | 134 | 1681 |
| B3-30 | 8:45 | 4/14/92 | 17 | 6.1 | 109 | 287 |
| B3-55 | 9:37 | 4/14/92 | 16.3 | 5.61 | 102 | 186 |
| B3-80 | 10:37 | 4/14/92 | 15 | 5.67 | 132 | 146 |
| C1-37 | 10:57 | 4/2/92 | 14.9 | 5.42 | 152 | 116 |
| C1-79 | 13:21 | 4/2/92 | 13.3 | 6.19 | 102 | 255 |
| C2-30 | 9:18 | 4/8/92 | 16.2 | 5.99 | 91 | 152 |
| C2-80 | 11:10 | 4/8/92 | 14.9 | 5.45 | 159 | 190 |
| C3-30 | 14:54 | 4/8/92 | 16.5 | 5.66 | 125 | 203 |
| C3-85 | 16:38 | 4/8/92 | 14.2 | 5.55 | 174 | 146 |
| D2.5-30 | 8:44 | 4/15/92 | 14.9 | 5.42 | 152 | 250 |
| D2.5-55 | 9:40 | 4/15/92 | 15.9 | 5.34 | 170 | 348 |
| D2.5-85 | 10:41 | 4/15/92 | 13.9 | 5.49 | 179 | 1250 |
| D2.75-30 | 10:36 | 4/17/92 | 16 | 5.6 | 126 | 198 |
| D2.75-55 | 11:27 | 4/17/92 | 14.9 | 5.4 | 165 | 229 |
| D2.75-85 | 12:30 | 4/17/92 | 13.9 | 5.37 | 160 | 227 |
| D3-27 | 14:40 | 4/13/92 | 14.9 | 5.6 | 126 | 165 |
| D3-52 | 15:43 | 4/13/92 | 16.2 | 5.5 | 152 | 208 |
| D3-83 | 16:30 | 4/13/92 | 15.7 | 5.2 | 165 | 196 |
| E1-35 | 9:36 | 4/2/92 | 14.3 | 5.46 | 140 | 120 |
| E1-80 | 12:07 | 4/2/92 | 13.3 | 5.67 | 137 | 278 |
| E2-30 | 11:33 | 4/7/92 | 14.8 | 5.89 | 102 | 141 |
| E2-80 | 13:55 | 4/7/92 | 14.4 | 5.66 | 52 | 292 |
| E3-25 | 13:30 | 4/13/92 | 15.7 | 5.98 | 117 | 483 |
| E3-55 | 14:29 | 4/13/92 | 16 | 5.43 | 155 | 348 |
| E3-80 | 15:33 | 4/13/92 | 14.9 | 5.55 | 148 | 279 |
| F1-30 | 13:28 | 4/3/92 | 14.2 | 5.31 | 178 | 110 |
| F1-55 | 14:42 | 4/3/92 | 13.3 | 5.19 | 190 | 200 |
| F1-80 | 12:42 | 4/6/92 | 13.9 | 5.54 | 138 | 187 |
| F2-30 | 9:47 | 4/16/92 | 15.7 | 5.87 | 16 | 365 |
| F2-55 | 10:34 | 4/16/92 | 13.7 | 5.4 | 93 | 181 |
| F2-81 | 11:45 | 4/16/92 | 13.5 | 5.66 | 102 | 259 |
| F3-25 | 9:22 | 4/13/92 | 14.1 | 5.43 | 140 | 96 |
| F3-55 | 10:13 | 4/13/92 | 15.1 | 6.05 | 80 | 190 |
| F3-80 | 11:17 | 4/13/92 | 14.8 | 5.5 | 134 | 320 |
| FG2-23 | 11:15 | 4/20/92 | 14.1 | 5.52 | 145 | 130 |
| FG2-53 | 11:56 | 4/20/92 | 14.6 | 5.57 | 159 | 158 |
| FG2-78 | 12:51 | 4/20/92 | 14.1 | 5.75 | 116 | 259 |
| G1-35 | 8:20 | 4/1/92 | 14.2 | 5.51 | 150 | 115 |
| G1-89 | 11:25 | 4/1/92 | 13.2 | 6.35 | -69 | 278 |
| G2-30 | 15:53 | 4/6/92 | 15.3 | 6.28 | 36 | 252 |
| G2-85 | 17:04 | 4/6/92 | 13.9 | 5.99 | 46 | 2750 |
| G2.25-30 | 14:21 | 4/16/92 | 15 | 5.88 | 113 | 230 |
| G2.25-55 | 15:16 | 4/16/92 | 14.7 | 5.06 | 125 | 137 |
| G2.25-85 | 16:22 | 4/16/92 | 13.8 | 4.95 | 180 | 745 |

# TABLE IV-2
# INORGANIC PARAMETER FIELD TESTING RESULTS
# BABYLON PLUME TRACKING INVESTIGATION, BABYLON, NY

| SAMPLE INTERVAL | TIME (24-hour) | DATE | TEMP. (°C) | pH (pH units) | eH (millivolts) | COND. (micromhos/cm) |
|---|---|---|---|---|---|---|
| G2.5-30 | 13:11 | 4/15/92 | 16.5 | 5.86 | 132 | 505 |
| G2.5-55 | 14:28 | 4/15/92 | 15.6 | 5.05 | 195 | 228 |
| G2.5-85 | 15:34 | 4/15/92 | 14.5 | 4.42 | 264 | 246 |
| G3-30 | 9:35 | 4/13/92 | 14.9 | 6.3 | 93 | 313 |
| G3-55 | 10:25 | 4/13/92 | 15 | 5.5 | 108 | 163 |
| G3-82 | 11:28 | 4/13/92 | 13.9 | 5.5 | 124 | 227 |
| H1-25 | 9:13 | 4/17/92 | 12.5 | 5.6 | 143 | 457 |
| H1-80 | 10:48 | 4/17/92 | 12.8 | 5.6 | 117 | 279 |
| J1-32 | 13:30 | 3/31/92 | 13.1 | 5.3 | 201 | 127 |
| J1-60 | 12:58 | 4/1/92 | 13.4 | 5.5 | 180 | 205 |
| J2-32 | 10:10 | 4/7/92 | 15.8 | 5.6 | 146 | 128 |
| J2-87 | 11:58 | 4/7/92 | 13.9 | 6.75 | -73 | 292 |
| J3-25 | 11:24 | 4/10/92 | 14.8 | 6.14 | 91 | 332 |
| J3-80 | 12:45 | 4/10/92 | 16.3 | 6.76 | -108 | 845 |
| K1-25 | 15:51 | 4/16/92 | 12.5 | 5.57 | 151 | 119 |
| K1.5-25 | 9:02 | 4/16/92 | 14.9 | 4.8 | -33 | 1300 |
| K2-25 | 15:02 | 4/15/92 | 13.8 | 5.8 | 155 | 341 |
| K2.5-25 | 10:55 | 4/15/92 | 12.6 | 6.1 | 114 | 149 |
| K3-25 | 11:49 | 4/10/92 | 15.1 | 5.85 | 93 | 177 |
| K3-82 | 13:36 | 4/10/92 | 14.2 | 6.74 | -35 | 351 |
| L1-25 | 9:49 | 4/3/92 | 12.9 | 5.4 | 165 | 89 |
| L1-77 | 13:02 | 4/3/92 | 12.4 | 5.31 | 183 | 182 |
| L2-27 | 15:35 | 4/7/92 | 14.8 | 5.38 | 164 | 127 |
| L2-72 | 9:05 | 4/8/92 | 12.7 | 5.65 | 152 | 170 |
| L2.25-25 | 13:00 | 4/15/92 | 14.6 | 5.48 | 157 | 152 |
| L2.5-27 | 10:49 | 4/14/92 | 14.9 | 6.49 | -1 | 157 |
| L2.5-57 | 11:31 | 4/14/92 | 14.4 | 5.5 | 59 | 204 |
| L3-25 | 15:08 | 4/9/92 | 14.8 | 5.89 | 135 | 199 |
| L3-55 | 16:10 | 4/9/92 | 14.9 | 5.53 | 135 | 166 |
| L3-80 | 8:32 | 4/10/92 | 13.7 | 5.62 | 132 | 238 |
| M2-25 | 9:15 | 4/20/92 | 14.9 | 5.67 | 135 | 125 |
| M2.5-27 | 14:21 | 4/14/92 | 14 | 5.6 | 118 | 135 |
| M2.75-25 | 13:40 | 4/16/92 | 12.8 | 6.02 | 119 | 145 |
| M3-27 | 14:14 | 4/9/92 | 16.6 | 6.48 | 76 | 192 |
| M3-52 | 15:24 | 4/9/92 | 15.8 | 5.36 | 144 | 130 |
| M3-80 | 16:19 | 4/9/92 | 14.5 | 5.43 | 151 | 159 |
| N1-32 | 12:21 | 4/6/92 | 13.5 | 5.47 | 157 | 114 |
| N1-87 | 15:16 | 4/6/92 | 13.5 | 5.6 | 157 | 129 |
| N2-27 | 12:36 | 4/8/92 | 14.1 | 5.27 | 172 | 120 |
| N2-89 | 14:20 | 4/8/92 | 13.3 | 5.32 | 163 | 122 |
| N2.5-25 | 8:55 | 4/15/92 | 14.5 | 5.29 | 159 | 172 |
| N2.75-25 | 11:16 | 4/16/92 | 14.8 | 5.5 | 110 | 128 |
| N3-25 | 10:26 | 4/9/92 | 15.2 | 6.41 | -48 | 295 |
| N3-80 | 11:52 | 4/9/92 | 14.3 | 5.57 | 127 | 150 |
| O3-25 | 8:57 | 4/9/92 | 14.2 | 5.48 | 151 | 174 |
| O3-83 | 10:13 | 4/9/92 | 13.6 | 5.59 | 150 | 125 |
| AVG. SHALLOW | | | 14.7 | 5.70 | 120 | 224 |
| AVG. MIDDLE | | | 15.0 | 5.43 | 139 | 218 |
| AVG. DEEP | | | 14.0 | 5.65 | 116 | 406 |

10:40 AM

## TABLE IV–3
## VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
## BABYLON PLUME TRACKING INVESTIGATION BABYLON, NY

(ALL RESULTS ARE IN $\mu$g/l)

| | 1,1–DCA | 1,1–DCE | TCE | 1,2–DCE | PCE | 1,1,1–TCA | Benzene | Toluene | Vinyl Chl. | Total VOCs |
|---|---|---|---|---|---|---|---|---|---|---|
| A1–35 | ND | ND | ND | ND | BQL | ND | ND | ND | ND | ND |
| A1–80 | ND | ND | 6.9 | BQL | 220 | BQL | ND | ND | ND | 226.9 |
| A1–80B | ND | ND | BQL | BQL | 120 | BQL | ND | ND | ND | 120 |
| A1–80BDUP | ND | ND | 6.3 | BQL | 220 | BQL | ND | ND | ND | 226.3 |
| A3–55 | ND | ND | BQL | ND | 420 | BQL | ND | ND | ND | 420 |
| A3–85 | ND | ND | BQL | ND | 360 | BQL | ND | ND | ND | 360 |
| B3–30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| B3–55 | ND | ND | ND | ND | 21 | ND | ND | ND | ND | 21 |
| B3–80 | ND | ND | 7 | BQL | 360 | BQL | ND | ND | ND | 367 |
| C1–37 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| C1–79 | ND | BQL | 9.1 | BQL | 18 | 80 | ND | 8 | ND | 107.1 |
| C1–79DUP | ND | 5.3 | 9.4 | BQL | 23 | 88 | ND | 9.2 | ND | 125.7 |
| C2–30 | ND | ND | ND | ND | ND | BQL | ND | 15 | ND | ND |
| C2–80 | BQL | BQL | 12 | BQL | 78 | 51 | ND | ND | ND | 141 |
| C2–80DUP | BQL | BQL | 14 | BQL | 96 | 56 | ND | ND | ND | 166 |
| C3–30 | ND | ND | ND | BQL | BQL | BQL | ND | ND | ND | ND |
| C3–85 | ND | BQL | 18 | BQL | 190 | 14 | ND | ND | ND | 222 |
| D2.5–30 | ND | ND | BQL | ND | 40 | BQL | ND | ND | ND | 40 |
| D2.5–55 | 6.5 | ND | 22 | ND | 7.7 | 16 | ND | ND | ND | 52.2 |
| D2.5–85 | ND | ND | 21 | ND | BQL | 12 | ND | ND | ND | 33 |
| D2.75–30 | 6.8 | ND | 130 | 55 | 600 | 11 | ND | ND | ND | 802.8 |
| D2.75–55 | 6.7 | ND | ND | ND | ND | ND | ND | ND | ND | 6.7 |
| D2.75–85 | BQL | 5.9 | 77 | BQL | 59 | 45 | ND | ND | ND | 186.9 |
| D3–27 | ND | ND | 8.2 | BQL | 370 | 8.2 | ND | ND | ND | 386.4 |
| D3–52 | ND | ND | 14 | ND | 400 | 6.3 | ND | ND | ND | 420.3 |
| D3–83 | BQL | 6.2 | 53 | BQL | 75 | 53 | ND | ND | ND | 187.2 |
| E1–35 | ND | ND | BQL | ND | BQL | ND | ND | ND | ND | ND |
| E1–80 | ND | BQL | 17 | BQL | 38 | 10 | ND | ND | ND | 65 |
| E2–30 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| E2–80 | BQL | 7 | 26 | BQL | 6.1 | 95 | ND | ND | ND | 134.1 |
| E2–80DUP | BQL | 6.7 | 26 | ND | 6.5 | 88 | ND | ND | ND | 127.2 |
| E3–25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| E3–55 | ND | ND | 33 | ND | ND | 20 | ND | ND | ND | 53 |
| E3–80 | ND | 5.3 | 85 | ND | 11 | 53 | ND | ND | ND | 154.3 |
| F1–30 | ND | ND | 28 | 10 | 260 | ND | ND | ND | ND | 298 |
| F1–55 | ND | ND | 20 | BQL | 140 | 14 | ND | ND | ND | 174 |
| F1–80 | 12 | BQL | 33 | BQL | 85 | 59 | ND | ND | ND | 189 |
| F2–30 | ND | ND | ND | ND | 22 | ND | ND | ND | ND | 22 |
| F2–55 | ND | ND | 24 | ND | 20 | 10 | ND | ND | ND | 54 |

## TABLE IV-3
## VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
## BABYLON PLUME TRACKING INVESTIGATION BABYLON, NY

(ALL RESULTS ARE IN $\mu$g/l)

| | 1,1-DCA | 1,1-DCE | TCE | 1,2-DCE | PCE | 1,1,1-TCA | Benzene | Toluene | Vinyl Chl. | Total VOCs |
|---|---|---|---|---|---|---|---|---|---|---|
| F2-81 | ND | ND | 54 | 13 | 45 | 16 | ND | ND | ND | 128 |
| F3-25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| F3-55 | ND | ND | 16 | ND | 7.4 | ND | ND | ND | ND | 23.4 |
| F3-80 | ND | ND | 12 | ND | 21 | 11 | ND | ND | ND | 44 |
| FG2-23 | ND | ND | BQL | ND | 36 | ND | ND | ND | ND | 36 |
| FG2-53 | ND | ND | 220 | 70 | 1300 | BQL | ND | ND | ND | 1590 |
| FG2-78 | 16 | 52 | 400 | 51 | 1000 | 360 | ND | ND | ND | 1879 |
| G1 Bailer Blank | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| G1-35 | ND | ND | 130 | ND | ND | ND | ND | ND | ND | 130 |
| G1-35DUP | ND | ND | 110 | ND | ND | ND | ND | ND | ND | 110 |
| G1-89 | ND | BQL | 100 | 8 | 320 | ND | ND | ND | ND | 428 |
| G1-89B | ND | ND | 96 | 9.4 | 270 | ND | ND | ND | ND | 375.4 |
| G2-30 | ND | ND | BQL | ND | 6.6 | ND | ND | ND | ND | 6.6 |
| G2-85 | 35 | 17 | 120 | 49 | 68 | ND | ND | ND | ND | 289 |
| G2-85DUP | 33 | 16 | 120 | 46 | 74 | ND | ND | ND | ND | 289 |
| G2.25-30 | ND | ND | 12 | BQL | 45 | ND | ND | ND | ND | 57 |
| G2.25-55 | ND | ND | 110 | 22 | 790 | ND | ND | ND | ND | 922 |
| G2.25-55DUP | ND | ND | 110 | 22 | 800 | ND | ND | ND | ND | 932 |
| G2.25-85 | 19 | 44 | 660 | 200 | 3900 | 290 | ND | ND | ND | 5113 |
| G2.25-85DUP | 20 | 35 | 550 | 150 | 3200 | 220 | ND | ND | ND | 4175 |
| G2.5-30 | ND | ND | 7.4 | ND | 26 | BQL | ND | ND | ND | 33.4 |
| G2.5-55 | ND | ND | 47 | 10 | 290 | ND | ND | ND | ND | 347 |
| G2.5-85 | 8.9 | 13 | 880 | 120 | 4200 | 74 | ND | ND | ND | 5295.9 |
| G2.5-85DUP | 8.2 | 14 | 890 | 110 | 4400 | 76 | ND | ND | ND | 5498.2 |
| G3-30 | ND | ND | 19 | BQL | 110 | 7.1 | ND | ND | ND | 136.1 |
| G3-55 | BQL | BQL | 160 | 34 | 760 | 11 | ND | ND | ND | 965 |
| G3-82 | 8.1 | 15 | 380 | 60 | 1000 | 120 | ND | ND | ND | 1583.1 |
| G3-82DUP | 7.7 | 17 | 410 | 57 | 1200 | 130 | ND | ND | ND | 1821.7 |
| Hydrant | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| H1-25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| H1-80 | BQL | ND | BQL | ND | BQL | 6.1 | ND | ND | ND | 6.1 |
| J1-32 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| J1-60 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| J2-32 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| J2-87 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| J3-25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| J3-80 | ND | ND | ND | ND | ND | ND | BQL | ND | ND | ND |
| K1-25 | ND | ND | ND | ND | BQL | ND | ND | ND | ND | ND |

## TABLE IV-3
## VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
## BABYLON PLUME TRACKING INVESTIGATION BABYLON, NY

(ALL RESULTS ARE IN µg/l)

| | 1,1-DCA | 1,1-DCE | TCE | 1,2-DCE | PCE | 1,1,1-TCA | Benzene | Toluene | Vinyl Chl. | Total VOCs |
|---|---|---|---|---|---|---|---|---|---|---|
| K1.5-25 | ND | ND | ND | ND | ND | ND | ND | 1100 | ND | ND |
| K2-25 | ND | ND | 8.1 | ND | BQL | ND | ND | ND | ND | 8.1 |
| K2.5-25 | ND | ND | BQL | ND | 34 | ND | ND | ND | ND | 34 |
| K3-25 | ND | ND | BQL | ND | 7.2 | ND | ND | ND | ND | 7.2 |
| K3-25B | ND | ND | BQL | ND | 6 | ND | ND | ND | ND | 6 |
| K3-82 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| L1-25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| L1-77 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| L2-27 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| L2-72 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| L2.25-25 | 8.7 | 9.7 | ND | ND | 12 | 1500 | ND | ND | ND | 1530.4 |
| L2.5-27 | 23 | BQL | 34 | 140 | 18 | 81 | ND | ND | ND | 296 |
| L2.5-27DUP | 25 | BQL | 36 | 140 | 20 | 86 | ND | ND | ND | 307 |
| L2.5-57 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| L3-25 | 30 | 7.7 | 340 | 300 | 37 | 230 | ND | ND | ND | 944.7 |
| L3-55 | ND | ND | 420 | BQL | 10 | ND | ND | ND | ND | 430 |
| L3-80 | ND | ND | 11 | ND | ND | ND | ND | ND | ND | 11 |
| M2-25 | ND | ND | ND | ND | 9.2 | ND | ND | ND | ND | 9.2 |
| M2.5-27 | ND | ND | ND | ND | BQL | ND | ND | ND | ND | ND |
| M2.5-27B | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| M2.75-25 | ND | ND | BQL | ND | 470 | 12 | ND | ND | ND | 482 |
| M3-27 | 5.2 | ND | 22 | 37 | 37 | 5.4 | ND | ND | ND | 106.6 |
| M3-52 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| M3-80 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N1-32 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N1-87 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N2-27 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N2-89 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N2.5-25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N2.75-25 | ND | ND | ND | ND | BQL | ND | ND | ND | ND | ND |
| N3-25 | BQL | 13 | 190 | 31 | 55 | 7.5 | ND | ND | 53 | 349.5 |
| N3-25DUP | BQL | 15 | 210 | 30 | 61 | 8.6 | ND | ND | ND | 324.6 |
| N3-80 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N3-80DUP | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| O3-25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| O3-83 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

ND = NOT DETECTED
BQL = BELOW QUANTITATION LIMIT

09/01/92 D:\MSR\BABYLON\LOTUS\VOCDAT.WK3
10:41 AM

# TABLE IV–4
# VOC CONTAMINATION SUMMARY

| LOCATION | BORINGS IN AREA | DEPTH | COMPOUND | MAXIMUM CONC. (μg/l) |
|---|---|---|---|---|
| **WEST OF LANDFILL** | | | | |
| (1) GLEAM/FIELD | FG2, G2, G2.25, G2.5, G3 | SHALLOW | PCE | 110 |
| | | SHALLOW | TCE | 19 |
| | | MIDDLE | PCE | 1300 |
| | | MIDDLE | TCE | 220 |
| | | MIDDLE | 1,2–DCE | 34 |
| | | DEEP | PCE | 4300 |
| | | DEEP | TCE | 885 |
| | | DEEP | 1,2–DCE | 175 |
| | | DEEP | 1,1–DCE | 52 |
| | | DEEP | 1,1–DCA | 34 |
| | | DEEP | 1,1,1–TCA | 360 |
| | F1,G1 | SHALLOW | PCE | 260 |
| | | SHALLOW | TCE | 120 |
| | | DEEP | PCE | 295 |
| | | DEEP | TCE | 98 |
| (2) S. ALDER/BELL | A3,B3 | DEEP | PCE | 360 |
| | | MIDDLE | TCE | 420 |
| (3) SOUTHERN DALE | D2.5, D2.75, D3 | SHALLOW | PCE | 600 |
| | | SHALLOW | TCE | 130 |
| | | SHALLOW | 1,2–DCE | 55 |
| | | SHALLOW | 1,1,1–TCA | 11 |
| | | MIDDLE | PCE | 400 |
| | | MIDDLE | TCE | 22 |
| | | MIDDLE | 1,1,1–TCA | 20 |
| | | DEEP | PCE | 75 |
| | | DEEP | TCE | 77 |
| | | DEEP | 1,1,1–TCA | 53 |
| **EAST OF LANDFILL** | | | | |
| (4) S. LAMAR/MAHAN | L2.5, L3 | SHALLOW | PCE | 37 |
| | | SHALLOW | TCE | 340 |
| | | SHALLOW | 1,2–DCE | 300 |
| | | SHALLOW | 1,1–DCA | 30 |
| | | SHALLOW | 1,1,1–TCA | 230 |
| | | MIDDLE | PCE | 10 |
| | | MIDDLE | TCE | 420 |
| | | DEEP | TCE | 11 |
| | M2.75, M3 | SHALLOW | PCE | 470 |
| (5) M. LAMAR | L2.25, L2.5 | SHALLOW | PCE | 12 |
| | | SHALLOW | 1,1,1–TCA | 1500 |
| | | SHALLOW | 1,1–DCE | 10 |
| | | SHALLOW | 1,1–DCA | 9 |
| (6) S. NANCY | N3 | SHALLOW | PCE | 58 |
| | | SHALLOW | TCE | 200 |
| | | SHALLOW | 1,1–DCE | 14 |
| | | SHALLOW | 1,2–DCE | 31 |
| | | SHALLOW | VINYL CHL. | 53 |

## TABLE IV-5
## BABYLON PLUME TRACKING INVESTIGATION
## POTENTIAL SOURCE AREAS

| MAP | BLOCK | LOT | LOCATION | PLUME/SOURCE NUMBER | EVIDENCE OF SOLVENT USAGE/STORAGE/LEAKAGE | REFERENCE | COMPANY NAME |
|---|---|---|---|---|---|---|---|
| 76 | 1 | 8 | 140 GLEAM ST. | 1 | | | ATOMIC CARTING |
| 76 | 1 | 7 | 130 GLEAM ST. | 1 | | | ATOMIC CARTING |
| 73 | 2 | 31.1 | 110 FIELD ST. | 1 | | | REMARQUE MFG. |
| 73 | 2 | 30 | 170 FIELD ST. | 1 | | | |
| 73 | 2 | 31.2 | 100 FIELD STREET | 1 | 1,1,1-TCA, TCE, PCE in shallow groundwater | Callender, 1990 | US ELECTROPLATING |
| 73 | 2 | 28.1 | 190-210 FIELD ST. | 1 | | | |
| 76 | 1 | 5 | 151-155 FIELD ST. | 1 | | | |
| 76 | 1 | 6.2 | 128 GLEAM ST. | 1 | | | NO BUILDINGS |
| 76 | 1 | 2.1 | 207 FIELD ST. | 1 | | | RESIDENTIAL |
| 76 | 1 | 1.1 | 400 PATTON AVE. | 1 | PCE used as vapor degreaser | SCDHS, 1985 | LAWRENCE RIPAK |
| 76 | 1 | 6.1 | 120 GLEAM ST. | 1 | | | NO BUILDINGS |
| 73 | 2 | 29 | 180 FIELD ST. | 1 | | | |
| 76 | 1 | 4/4.1 | 165 FIELD ST. | 1 | | | SEABERG PRECISION |
| 76 | 1 | 3 | 195 FIELD ST. | 1 | | | GOLCO REALTY CORP |
| 74 | 1 | 13 | EDISON AVE. | 2 | | | |
| 74 | 1 | 23.1 | 301 EDISON AVE. | 2 | | | MONT. CEMET. GARAGE (FORMER) |
| 74 | 2 | 14.1 | 80 DALE ST. | 3 | | | |
| 74 | 2 | 23.8 | 45 DALE ST. | 3 | | | UNIQUE SANITATION COMPANY |
| 74 | 2 | 13 | 70 DALE ST. | 3 | | | PHAESTRON EAST |
| 74 | 2 | 22 | 53 DALE ST. | 3 | | | |
| 74 | 2 | 12 | 60 DALE ST. | 3 | TCE, PCE, AND 1,1,1-TCA in shallow groundwater | Gibbs & Hill, 1992 | MIDMER-LOSH ORGAN CO. (FORMERLY NTU CIRCUITS) |
| 74 | 2 | 11 | 50 DALE ST. | 3 | TCE and 1,1,1-TCA in shallow groundwater | GRB and Galli, 1988 | SPECTRUM FINISHING |
| 74 | 2 | 21/21.1 | 55 DALE ST. | 3 | | | A&M CARTING/ASF-ACTIVE STORE FRONTS |
| 75 | 2 | 23.2 | 34A LAMAR ST | 4 | 1,1,1-TCA stored on property | SCDHS, 1984 | NASSAU TOOL WORKS |
| 78 | 1 | 9.2 | 30 MAHAN ST. | 4 | | | HARRAN TRANSPORTATION |
| 78 | 1 | 9/9.1 | 9 LAMAR ST. | 4 | | | PENNZOIL PRODUCTS |
| 78 | 1 | 10.1 | 65 EDISON AVENUE | 4 | | | |
| 75 | 2 | 23.1 | 8 LAMAR ST | 4 | | | |
| 78 | 1 | 1 | 63 LAMAR ST. | 5 | | | CH. WOLF & SONS |
| 75 | 2 | 27.1 | 48 LAMAR ST | 5 | | | |
| 75 | 2 | 28.1 | 58 LAMAR ST | 5 | | | |
| 76 | 2 | 18 | 69-71 KEAN ST. | 5 | 1,1,1-TCA and 1,1-DCA in | | JFB LITHO |
| 76 | 2 | 17 | 75 KEAN ST. | 5 | sanitary pool. | SCDHS, 1988 | JFB LITHO |
| 76 | 2 | 19 | 68 LAMAR ST. | 5 | | | |
| 76 | 2 | 20 | 78 LAMAR ST. | 5 | 1,1,1-TCA, TCE, and 1,1-DCA in | $H_2M$ Group, 1991 | PRIDE |
| 76 | 2 | 21 | 88 LAMAR ST. | 5 | shallow groundwater. | | PRIDE |
| 78 | 1 | 11.2 | 5 MAHAN ST. | 6 | | | |
| 78 | 1 | 11.1 | 45 EDISON AVE. | 6 | | | SUPER WEB PRESS |
| 78 | 1 | 30.1 | 35 EDISON AVE. | 6 | | | CLOSED LOT |

SOURCE: COUNTY OF SUFFOLK REAL PROPERTY TAX SERVICE AGENCY.


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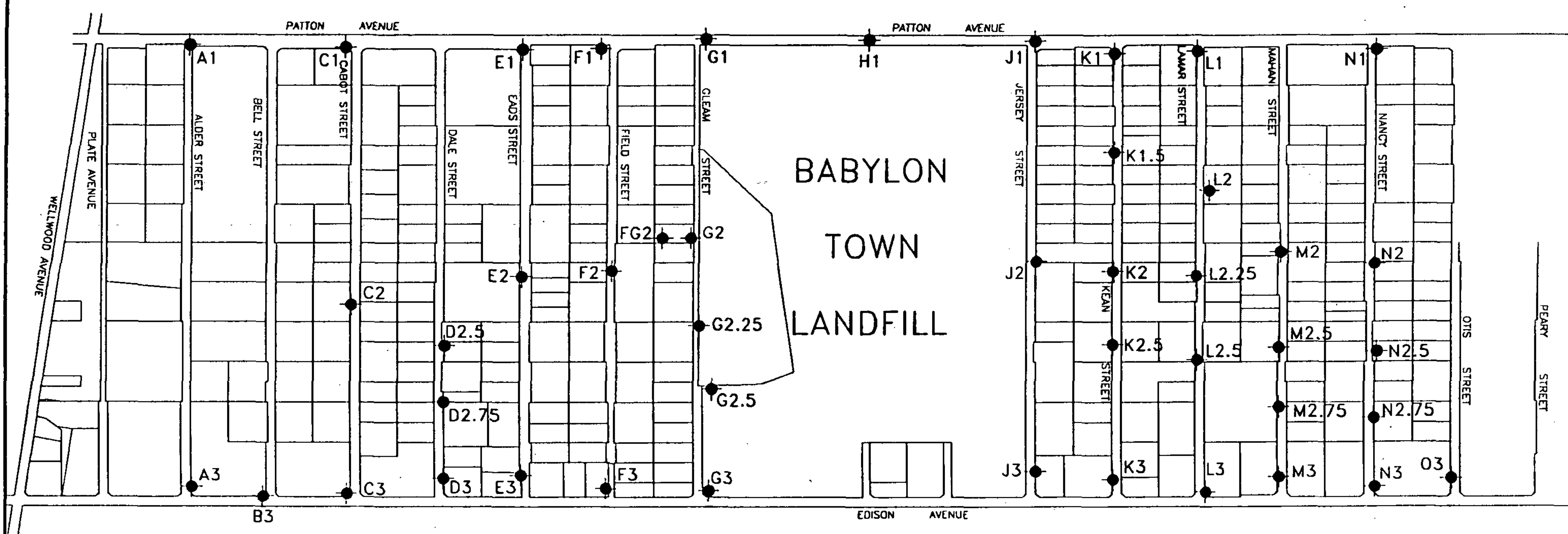
BABYLON PLUME TRACKING

SITE PLAN

FIGURE IV-1

00163110\SY274\SY274002.DWG | REVISED: 7/7/92




**LEGEND**

J3 BORING LOCATIONS

APPROXIMATE SCALE

500 0 500 FT.

500'

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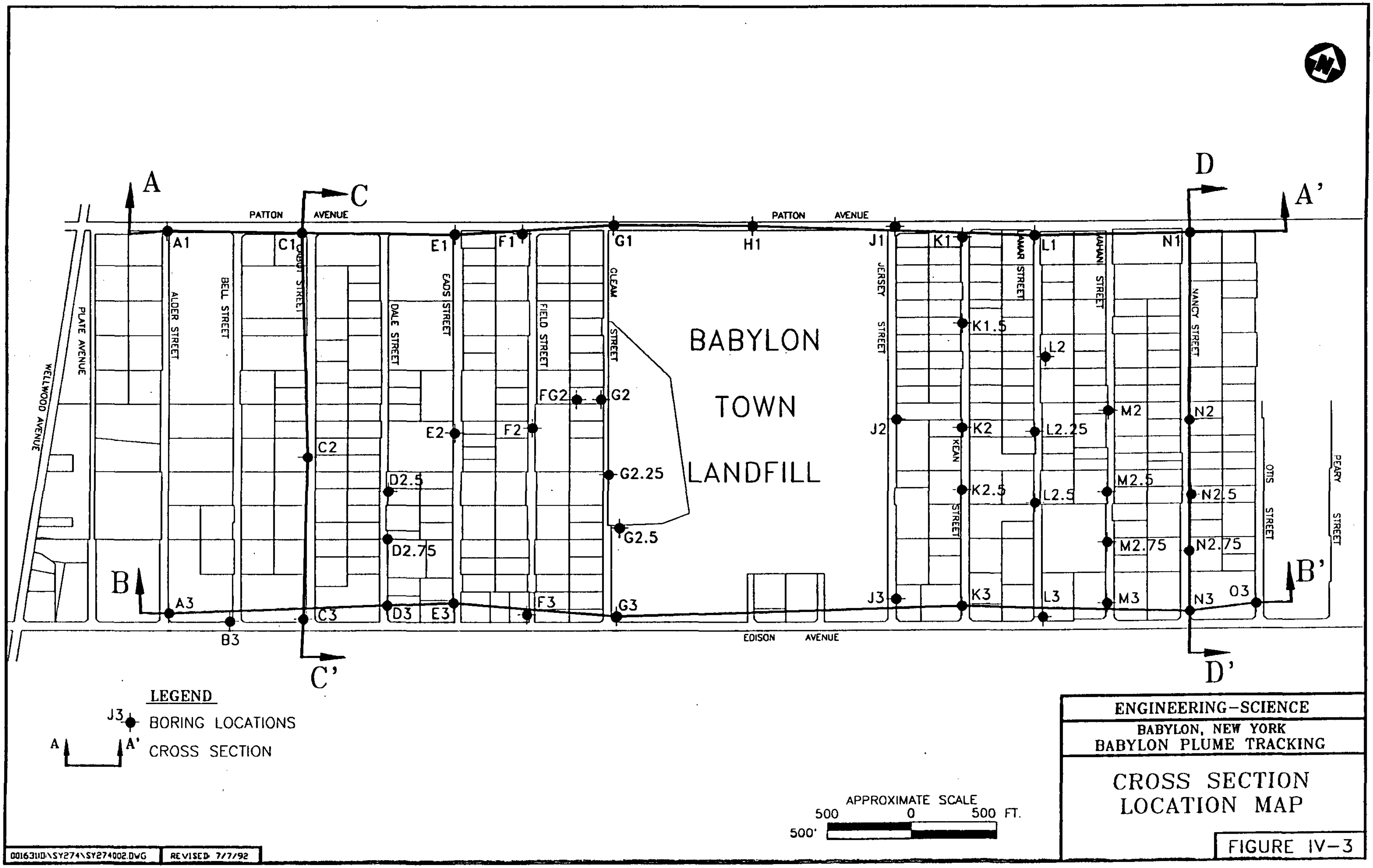
BABYLON PLUME TRACKING

BORING
LOCATION MAP

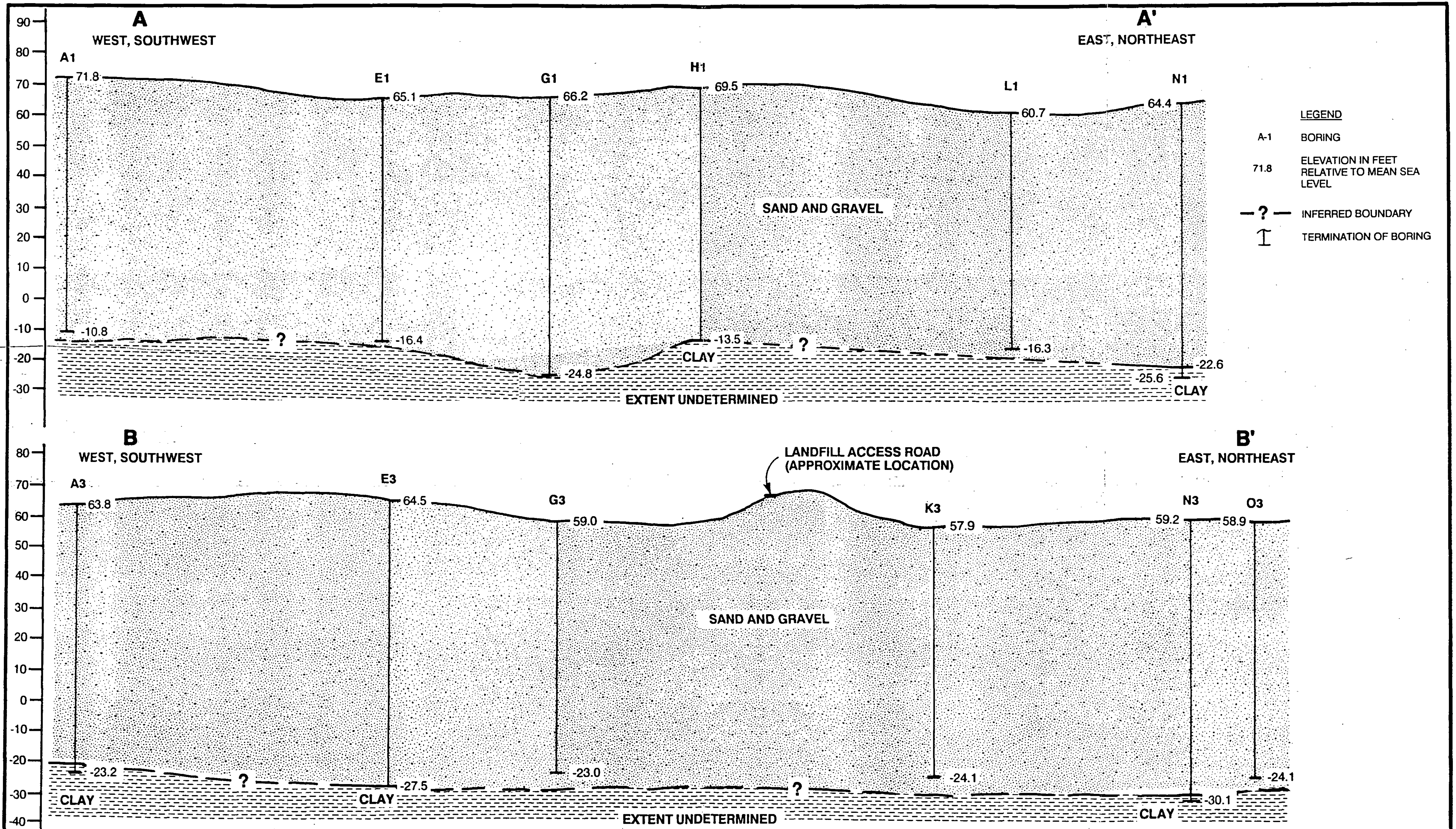
FIGURE IV-2

0016311D\SY274\SY274002.DWG REVISED: 7/7/92



A
A'
B
B'
C
C'
D
D'
PATTON AVENUE
EDISON AVENUE
PLATE AVENUE
WELLWOOD AVENUE
ALDER STREET
BELL STREET
CABOT STREET
DALE STREET
EADS STREET
FIELD STREET
GLEAM STREET
JERSEY STREET
KEAN STREET
LAMAR STREET
MAHAN STREET
NANCY STREET
OTIS STREET
PEARY STREET
BABYLON TOWN LANDFILL
A1
C1
E1
F1
G1
H1
J1
K1
L1
N1
K1.5
L2
FG2
G2
M2
N2
E2
F2
J2
K2
L2.25
C2
G2.25
D2.5
M2.5
K2.5
L2.5
N2.5
G2.5
D2.75
M2.75
N2.75
A3
B3
C3
D3
E3
F3
G3
J3
K3
L3
M3
N3
O3
LEGEND
J3 BORING LOCATIONS
A A' CROSS SECTION
APPROXIMATE SCALE
500 0 500 FT.
500'
ENGINEERING-SCIENCE
BABYLON, NEW YORK
BABYLON PLUME TRACKING
CROSS SECTION LOCATION MAP
FIGURE IV-3
00163110\SY274\SY274002.DWG
REVISED 7/7/92

FIGURE IV-4

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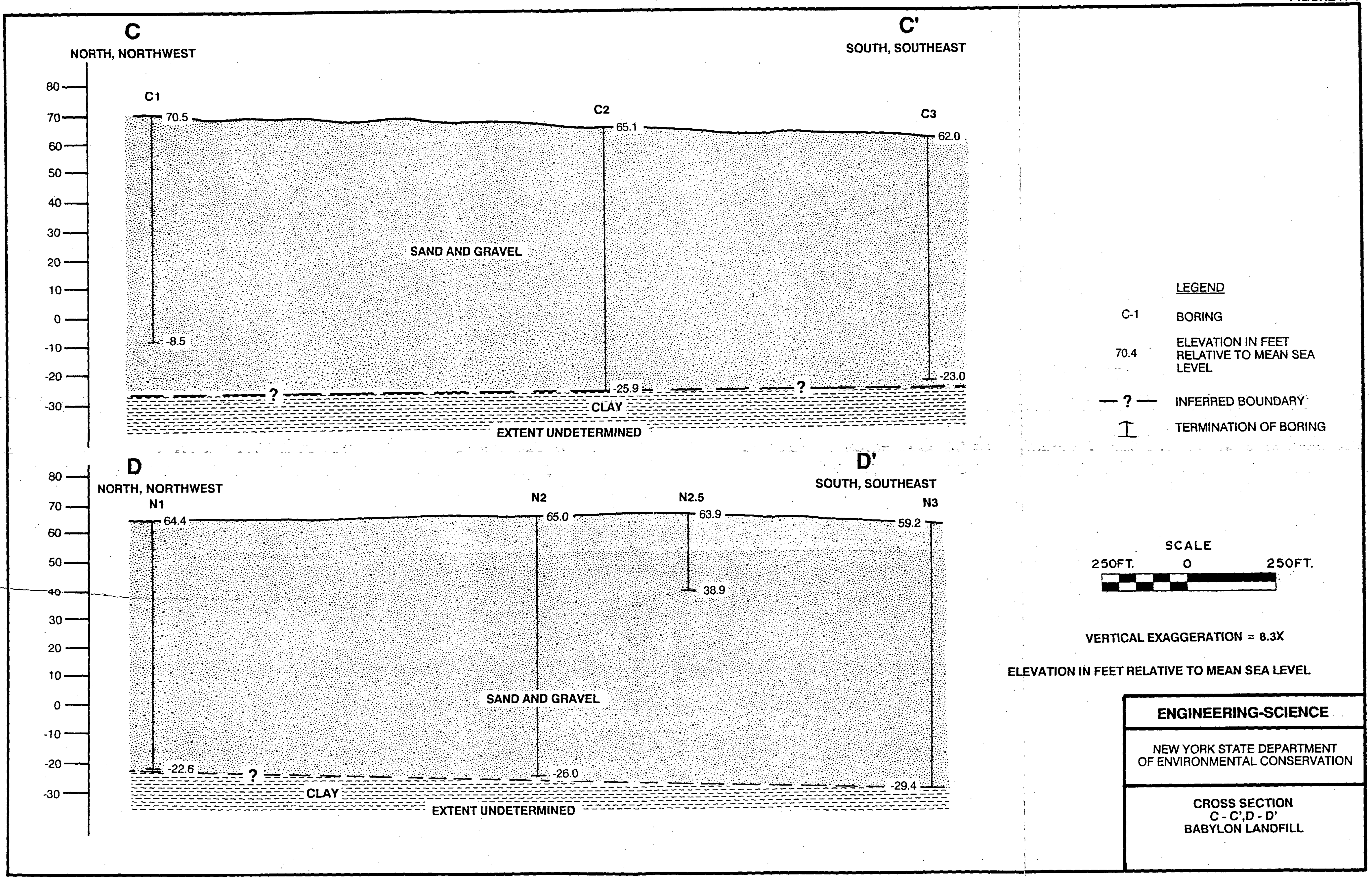
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

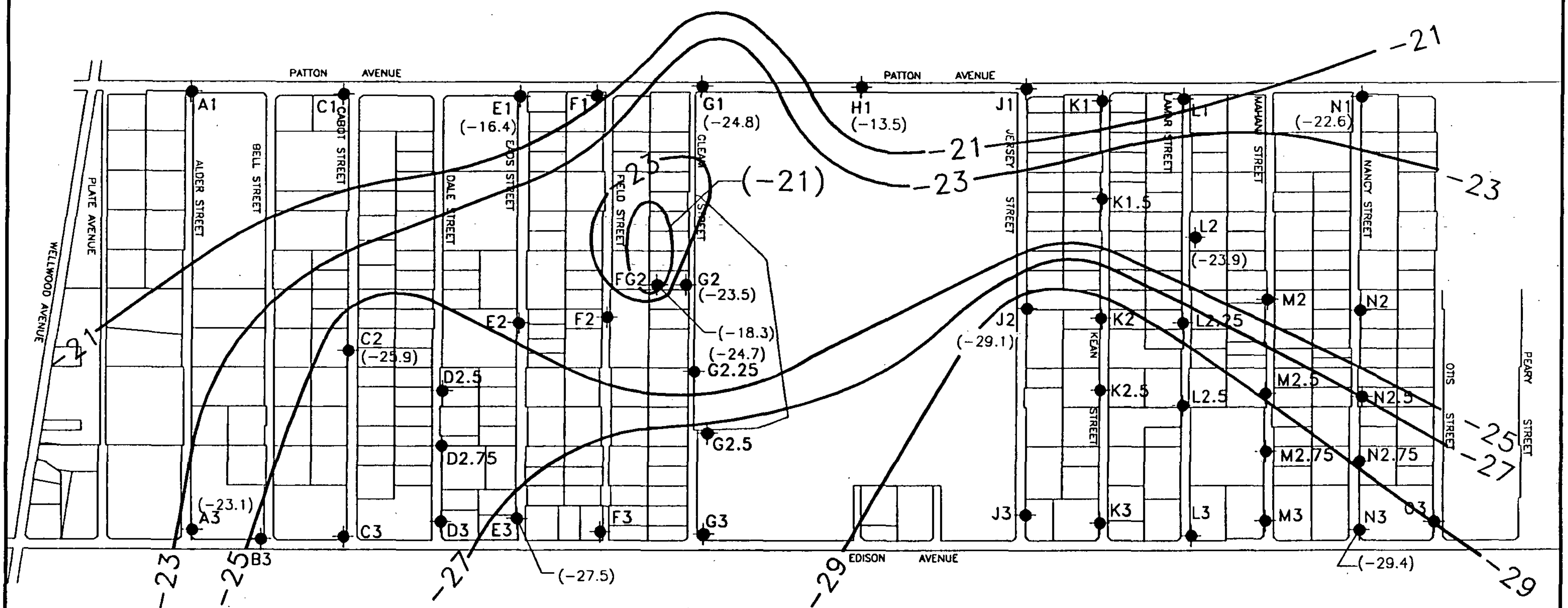
CROSS SECTION A - A', B - B' BABYLON LANDFILL

SY 274.05

FIGURE IV-5




SY274.05




LEGEND

J3 BORING LOCATIONS

-21- CONTOUR ELEVATION (MEASURED IN FEET ABOVE MEAN SEA LEVEL)

(-23.1) ELEVATION OF INTERFACE IN BORING

CONTOUR INTERVAL = 2 FEET

APPROXIMATE SCALE

500 0 500 FT.

500'

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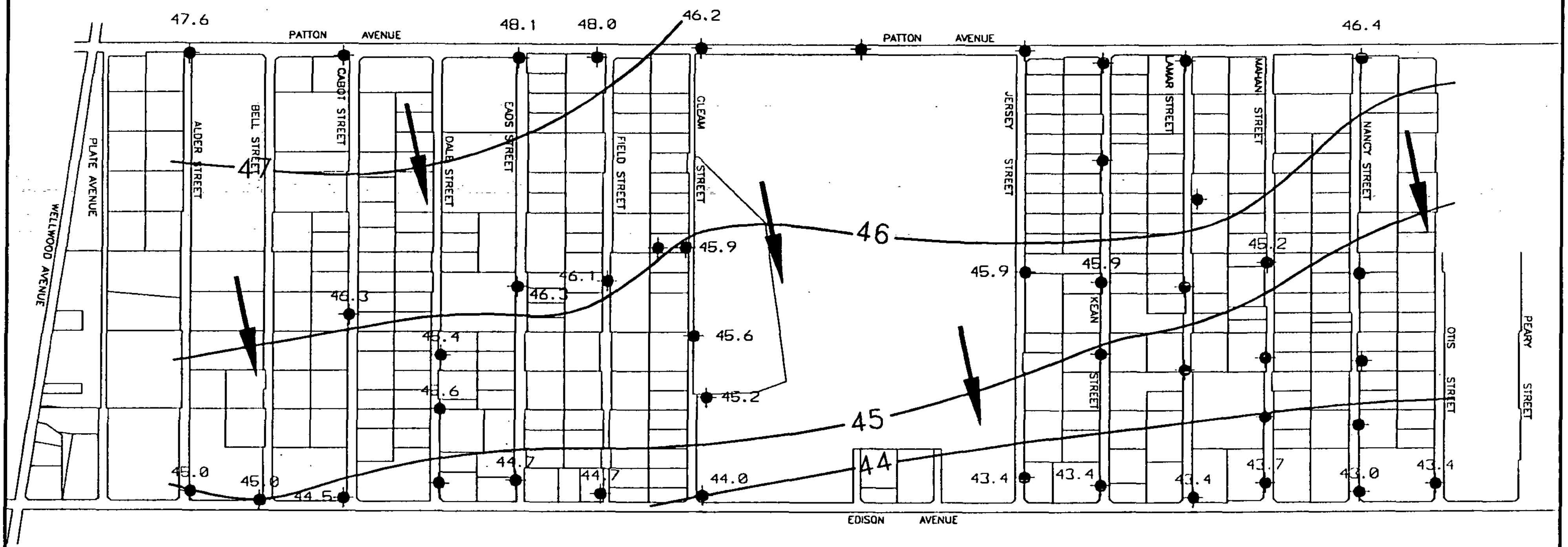
BABYLON PLUME TRACKING

CONTOUR MAP OF SAND/CLAY INTERFACE ELEVATION

FIGURE IV-6

001631ID\SY274\SY274002.DWG REVISED: 9/8/92

# GENERALIZED GROUNDWATER CONTOUR MAP – APRIL, 1992




LEGEND

BORING LOCATIONS

47.6 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

45 CONTOUR INTERVAL EQUALS 1 FOOT

GROUNDWATER FLOW DIRECTION

APPROXIMATE SCALE
500 0 500 FT.
500'

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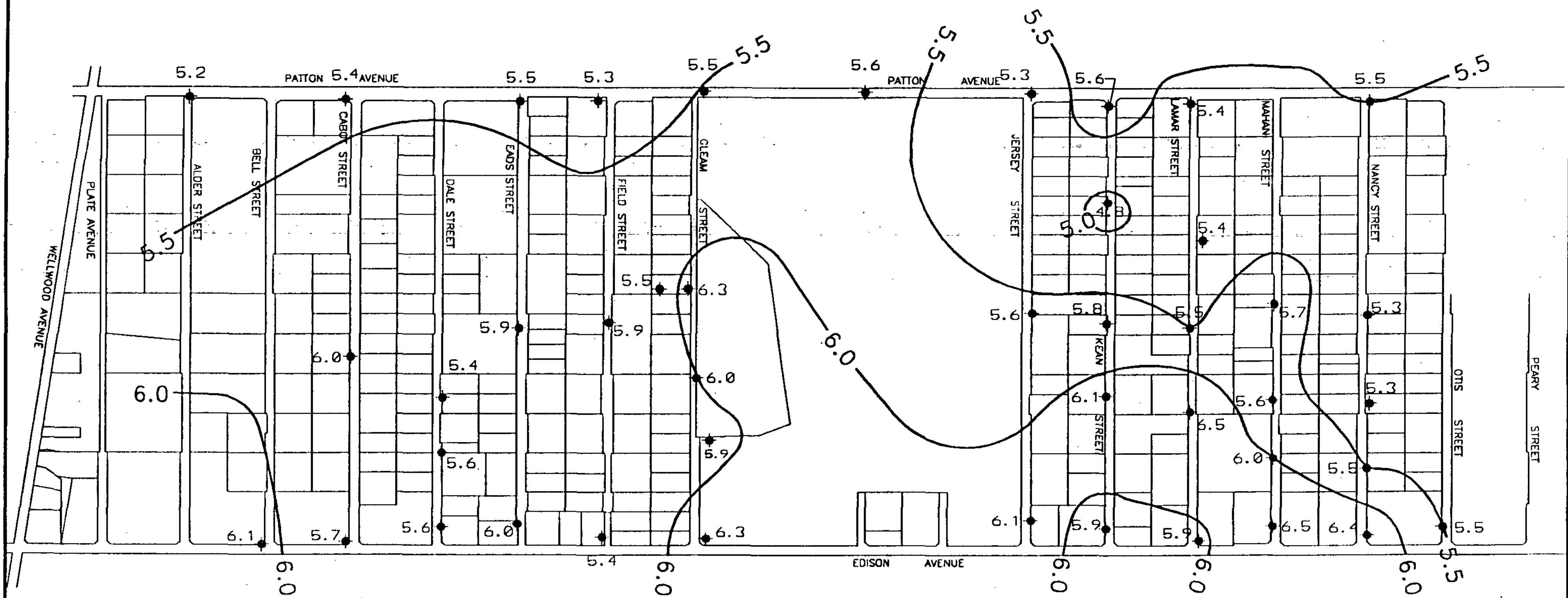
GROUNDWATER ELEVATION MAP

FIGURE IV–7

00163110\SY274\SY274002.DWG | REVISED 9/15/92

# PH IN SHALLOW ZONE




LEGEND

- BORING LOCATIONS
- 6.3 pH IN STANDARD pH UNITS
- 6.0 CONTOUR INTERVAL EQUALS 0.5 pH UNITS

APPROXIMATE SCALE
500 0 500 FT.
500'

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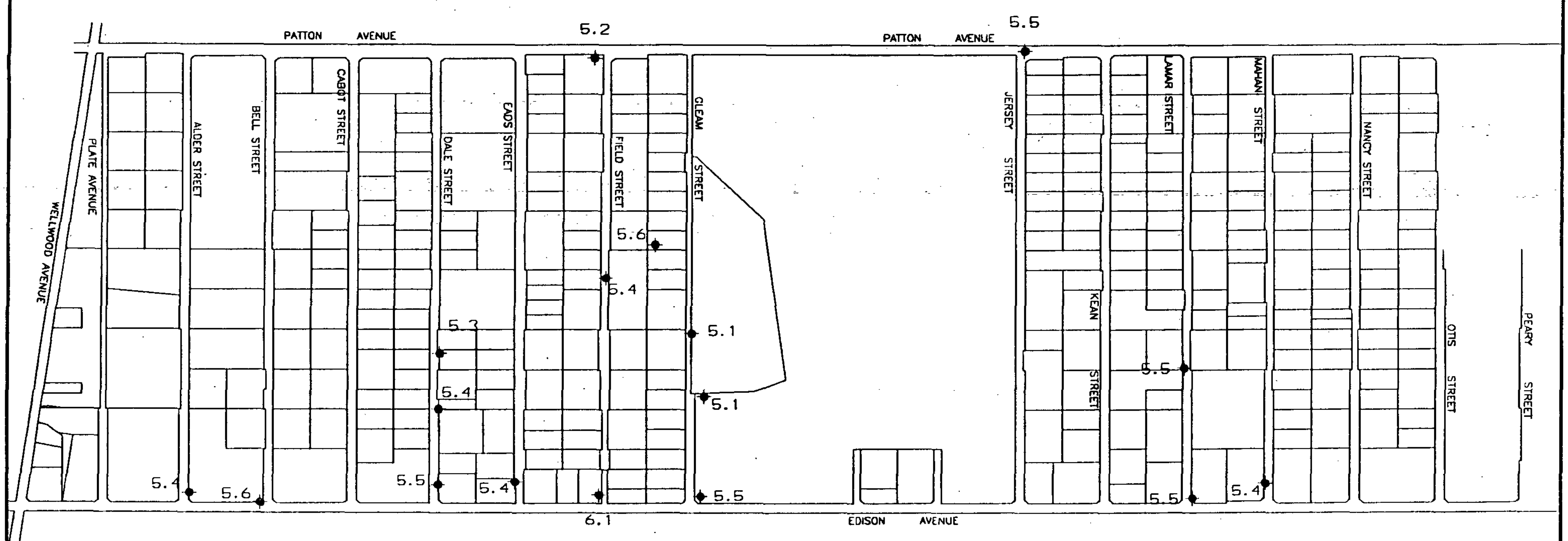
INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV-8

001631ID:\SY274\SY274002.DWG | REVISED: 7/7/92

# PH IN MIDDLE ZONE




**LEGEND**

BORING LOCATIONS

5.5 pH IN STANDARD pH UNITS

APPROXIMATE SCALE

500 0 500 FT.

500'

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INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV-9

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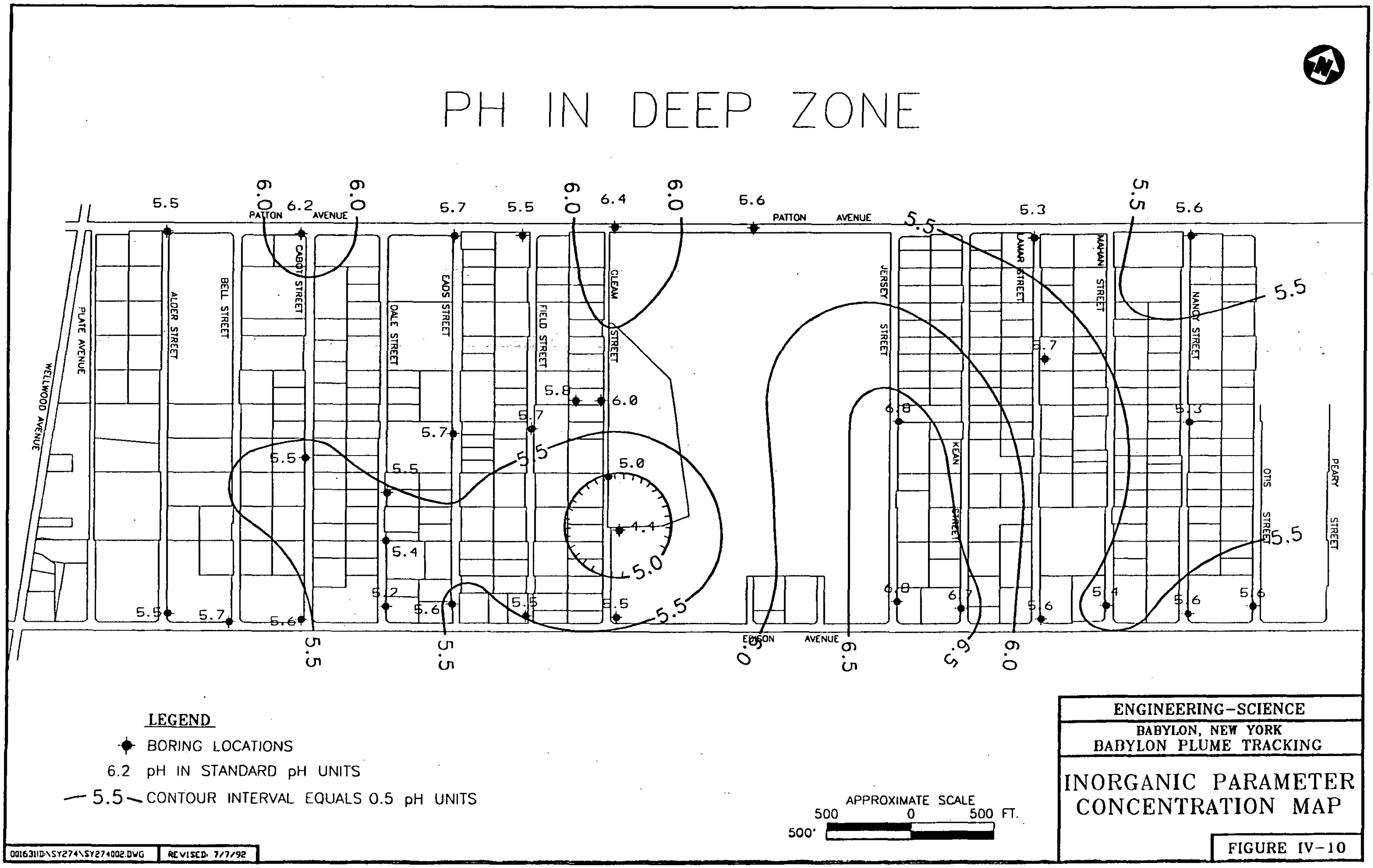


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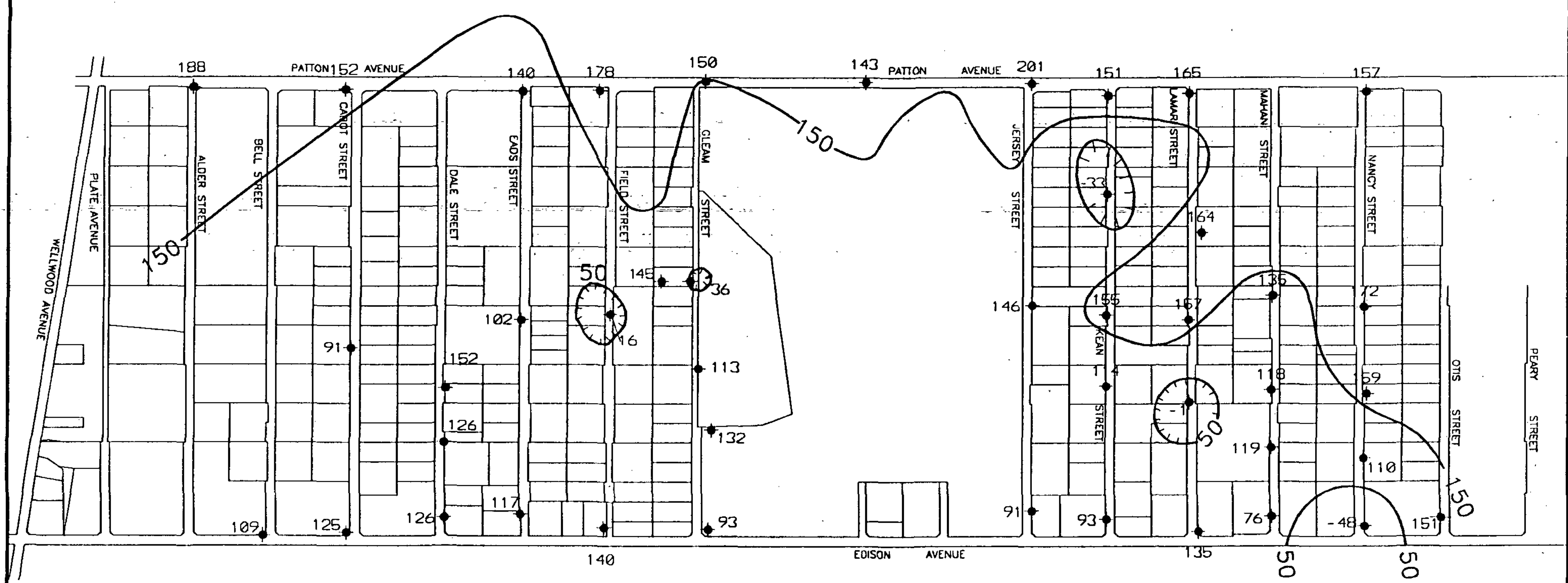
INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV-10

# EH IN SHALLOW ZONE




## LEGEND

- BORING LOCATIONS
- 126 EH READING IN mV (MILLIVOLTS)
- —50— CONTOUR INTERVAL EQUALS 100 mV (MILLIVOLTS)

APPROXIMATE SCALE
500 0 500 FT.
500'

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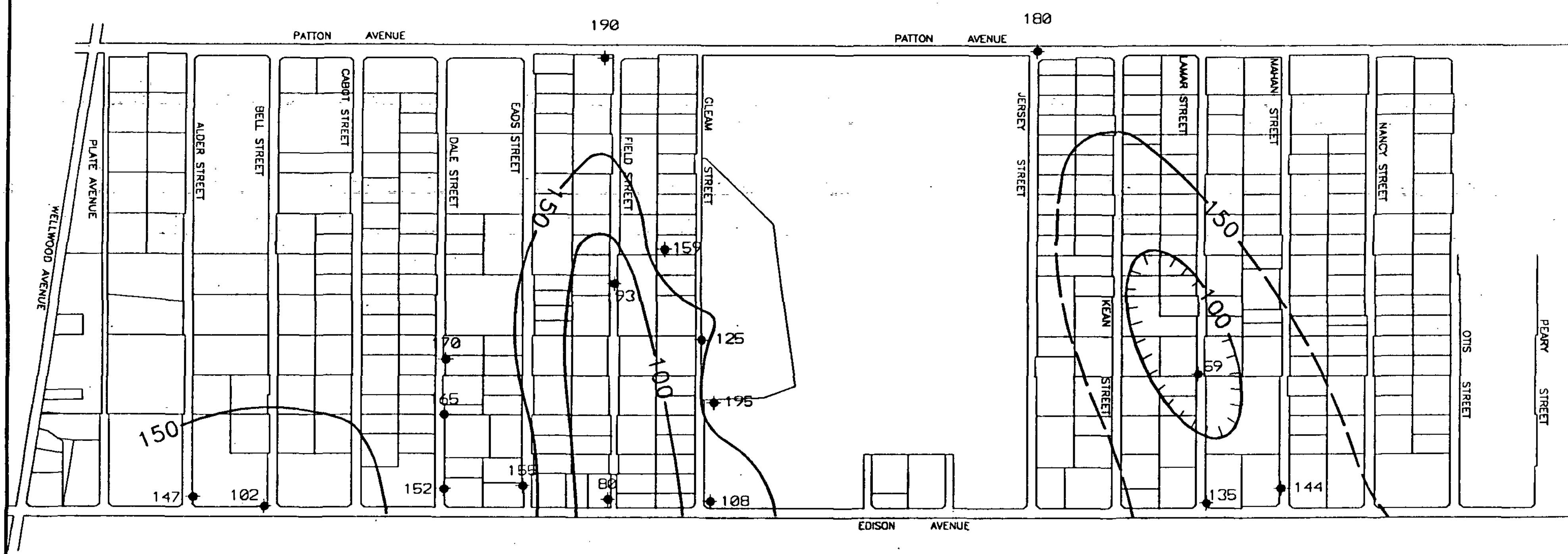
INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV–11

001631ID\SY274\SY274002.DWG | REVISED 9/8/92

# EH IN MIDDLE ZONE




**LEGEND**

- BORING LOCATIONS
- 144 EH READING IN mV (MILLIVOLTS)
- —100— CONTOUR INTERVAL EQUALS 50 mV (MILLIVOLTS)

APPROXIMATE SCALE
500 0 500 FT.
500'

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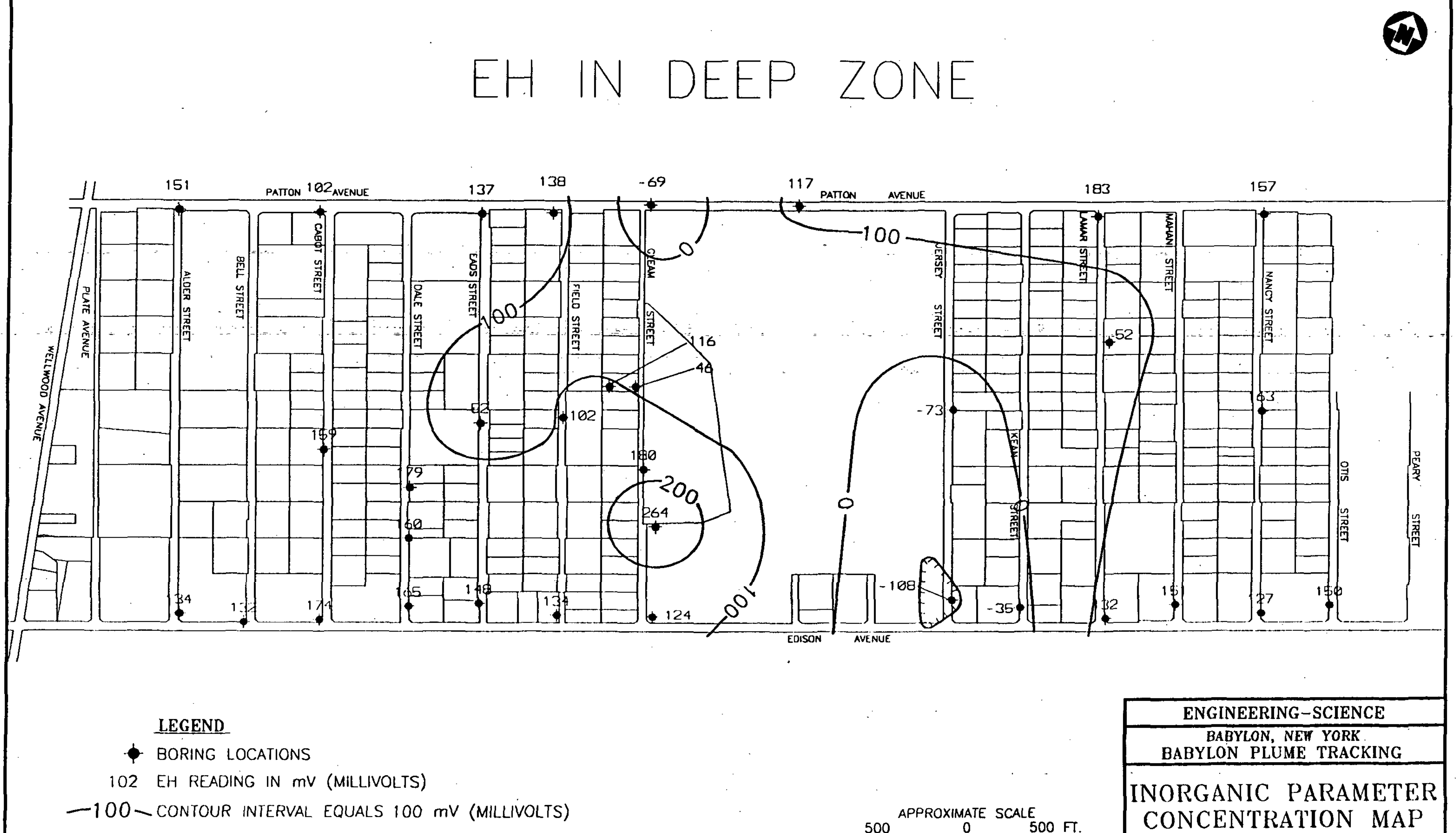
INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV-12

00163110\SY274\SY274002.DWG | REVISED 9/2/92

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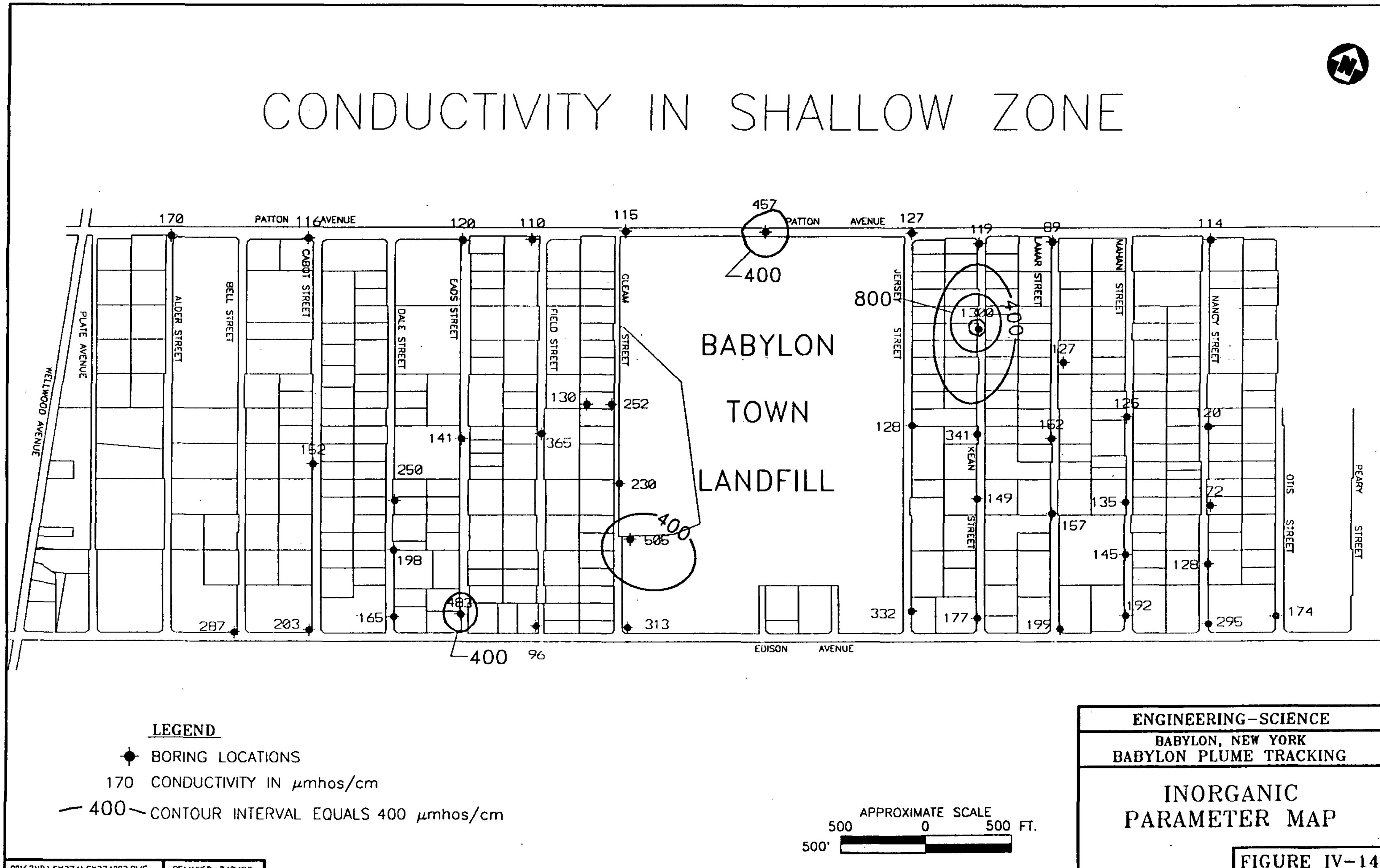
INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV-13

00163110\SY274\SY274002.DWG | REVISED: 7/7/92

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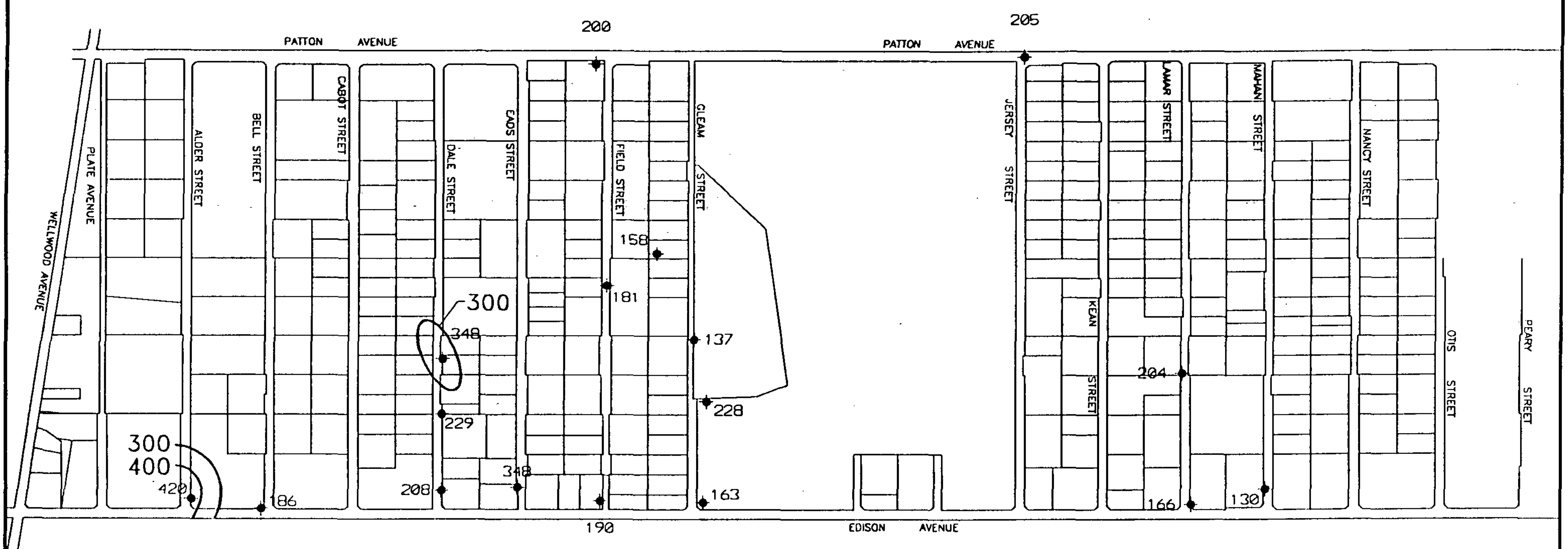
INORGANIC PARAMETER MAP

FIGURE IV-14

0016311D\SY274\SY274002.DWG | REVISED 7/7/92

# CONDUCTIVITY IN MIDDLE ZONE




**LEGEND**

BORING LOCATIONS

163 CONDUCTIVITY IN μmhos/cm

—300— CONTOUR INTERVAL EQUALS 100 μmhos/cm

APPROXIMATE SCALE
500 0 500 FT.
500'

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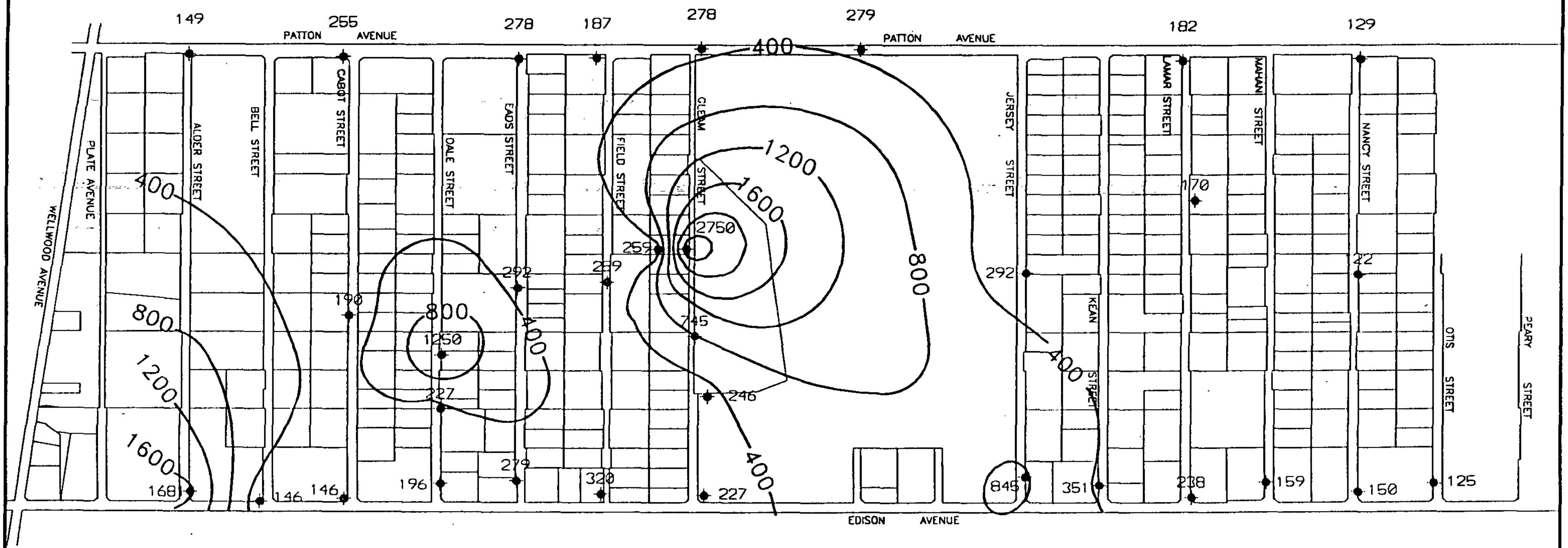
BABYLON PLUME TRACKING

INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV-15

00163110\SY274\SY274002.DWG | REVISED 7/7/92

# CONDUCTIVITY IN DEEP ZONE




LEGEND

BORING LOCATIONS

227 CONDUCTIVITY IN $\mu$mhos/cm

—400— CONTOUR INTERVAL EQUALS 400 $\mu$mhos/cm

APPROXIMATE SCALE

500 0 500 FT.

500'

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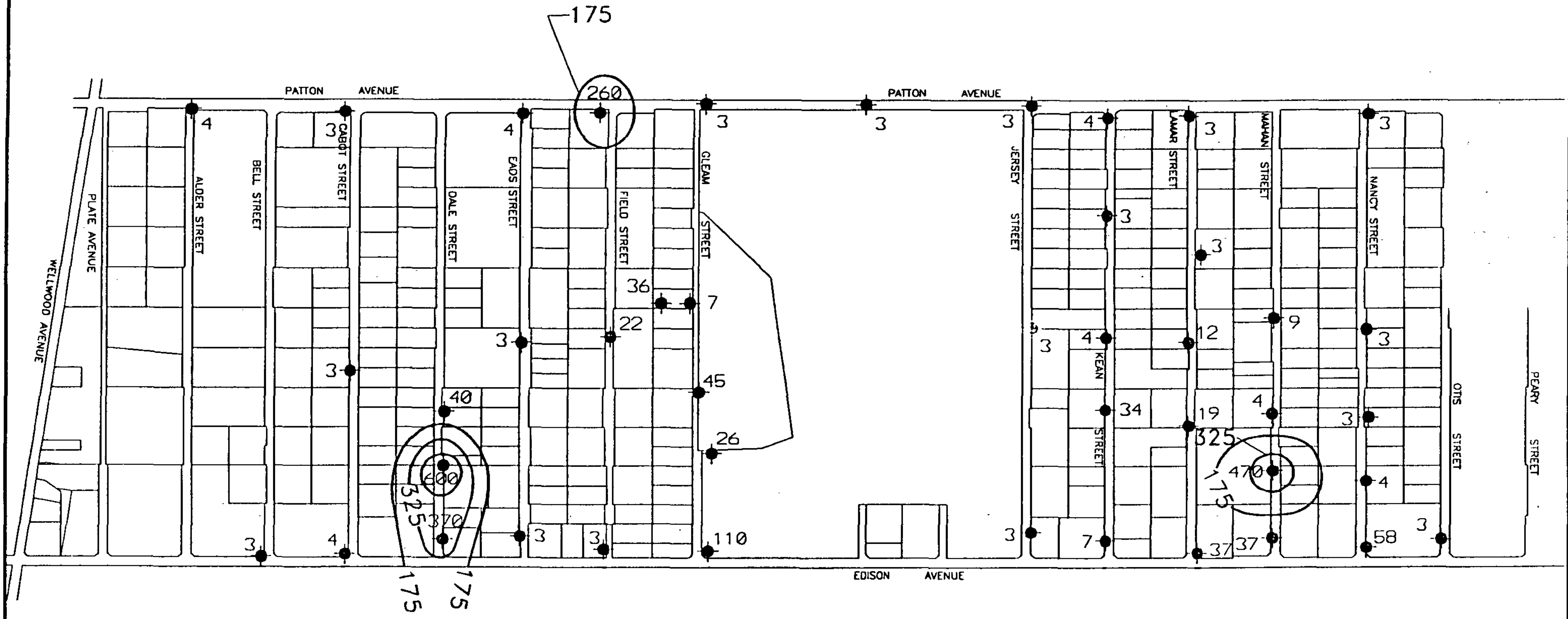
INORGANIC PARAMETER CONCENTRATION MAP

FIGURE IV-16

0016311D\SY274\SY274002.DWG | REVISED 7/7/92

# PCE CONCENTRATION IN SHALLOW ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —175— CONTOUR INTERVAL EQUALS 150 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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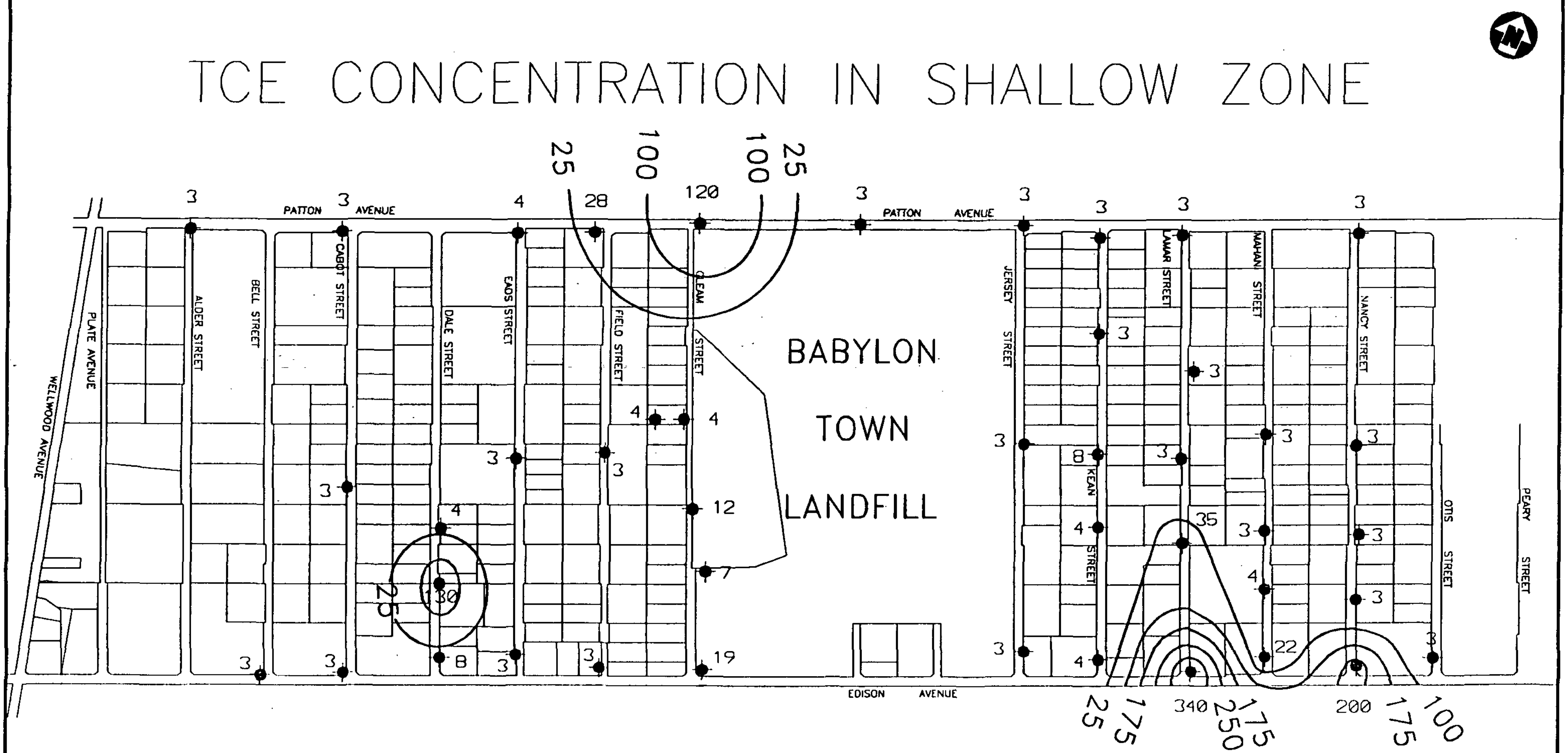
VOC CONCENTRATION MAP

FIGURE IV-17

00163110-\SY274\SY274002.DWG | REVISED 7/7/92

# TCE CONCENTRATION IN SHALLOW ZONE




LEGEND

- BORING LOCATIONS

3 CONCENTRATION IN $\mu g/l$

—175— CONTOUR INTERVAL EQUALS 75 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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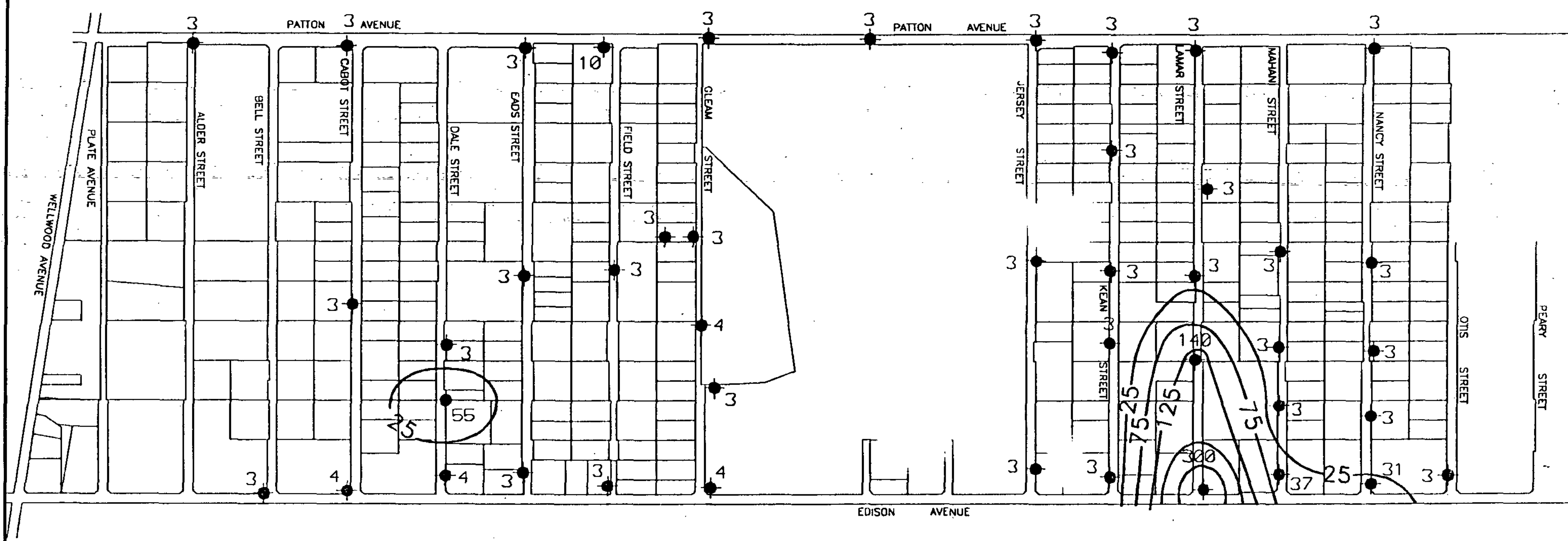
VOC
CONCENTRATION MAP

FIGURE IV-18

001631ID\SY274\SY274002.DWG | REVISED: 7/7/92

# 1,2 – DCE CONCENTRATION IN SHALLOW ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- — 25 — CONTOUR INTERVAL EQUALS 50 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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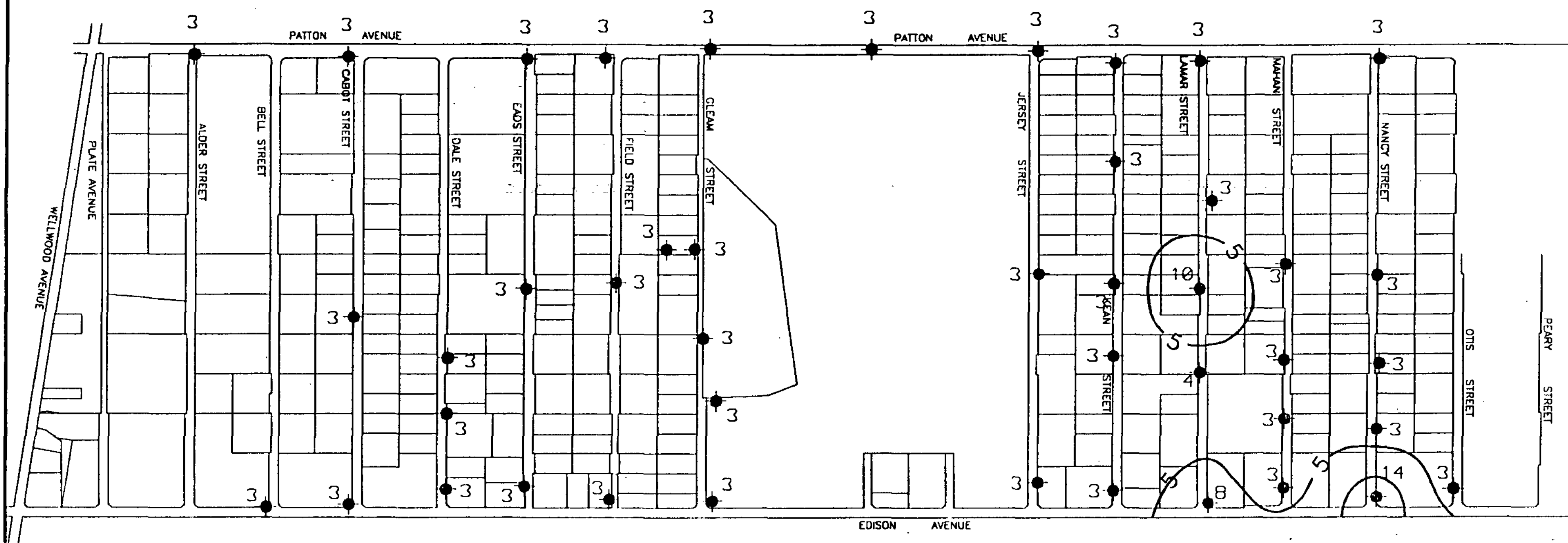
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-19

001631ID\SY274\SY274002.DWG | REVISED: 7/7/92

# 1,1 – DCE CONCENTRATION IN SHALLOW ZONE




LEGEND

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —10— CONTOUR INTERVAL EQUALS 5 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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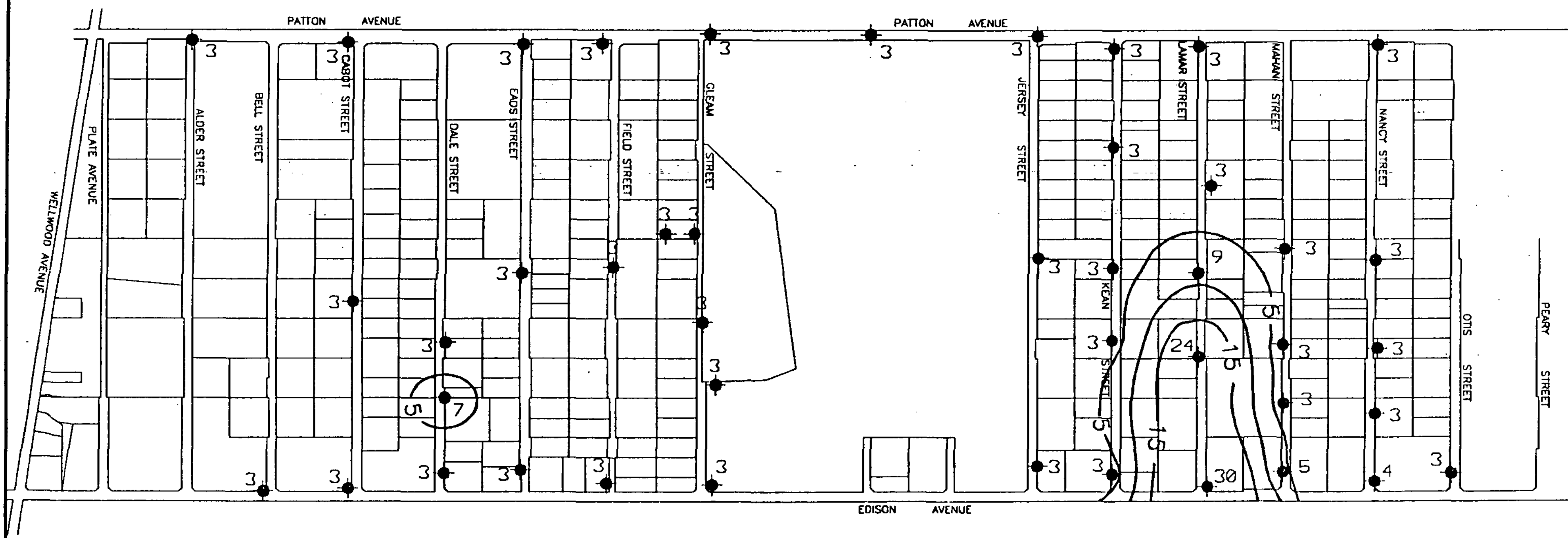
BABYLON PLUME TRACKING

VOC
CONCENTRATION MAP

FIGURE IV–20

00163110:\SY274\SY274002.DWG | REVISED: 7/7/92

# 1,1 – DCA CONCENTRATION IN SHALLOW ZONE




LEGEND

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —15— CONTOUR INTERVAL EQUALS 5 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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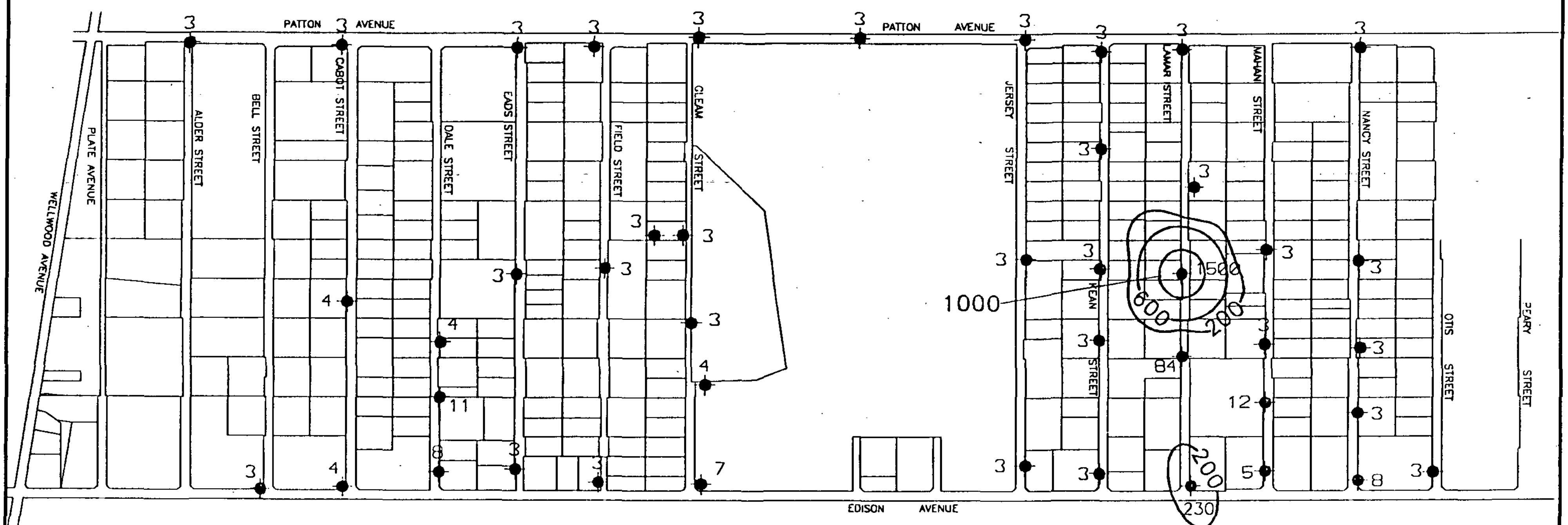
BABYLON, NEW YORK
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-21

00163110\SY274\SY274002.DWG | REVISED 7/7/92

# 1,1,1 – TCA CONCENTRATION IN SHALLOW ZONE




**LEGEND**

BORING LOCATIONS

3 CONCENTRATION IN $\mu g/l$

—210— CONTOUR INTERVAL EQUALS 400 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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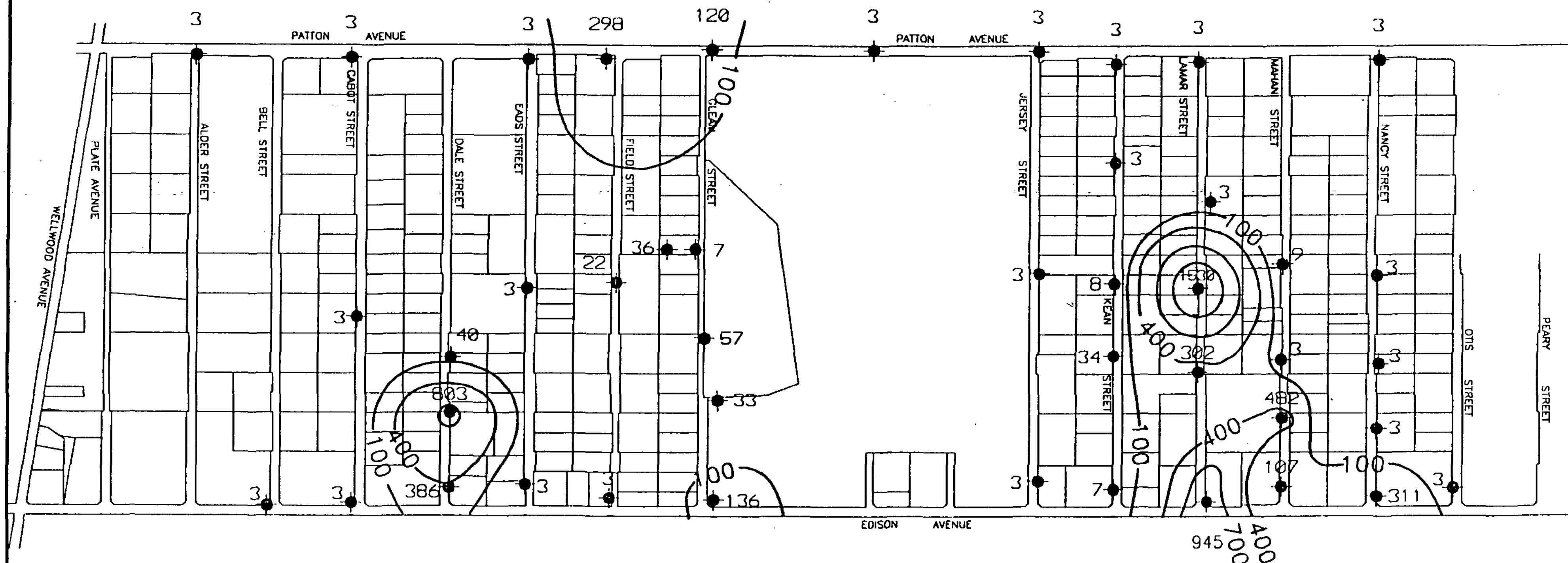
BABYLON, NEW YORK
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-22

001631ID\SY274\SY274002.DWG | REVISED: 7/7/92

# TOTAL CHLORINATED ORGANICS CONCENTRATION IN SHALLOW ZONE




## LEGEND

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —100— CONTOUR INTERVAL EQUALS 300 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

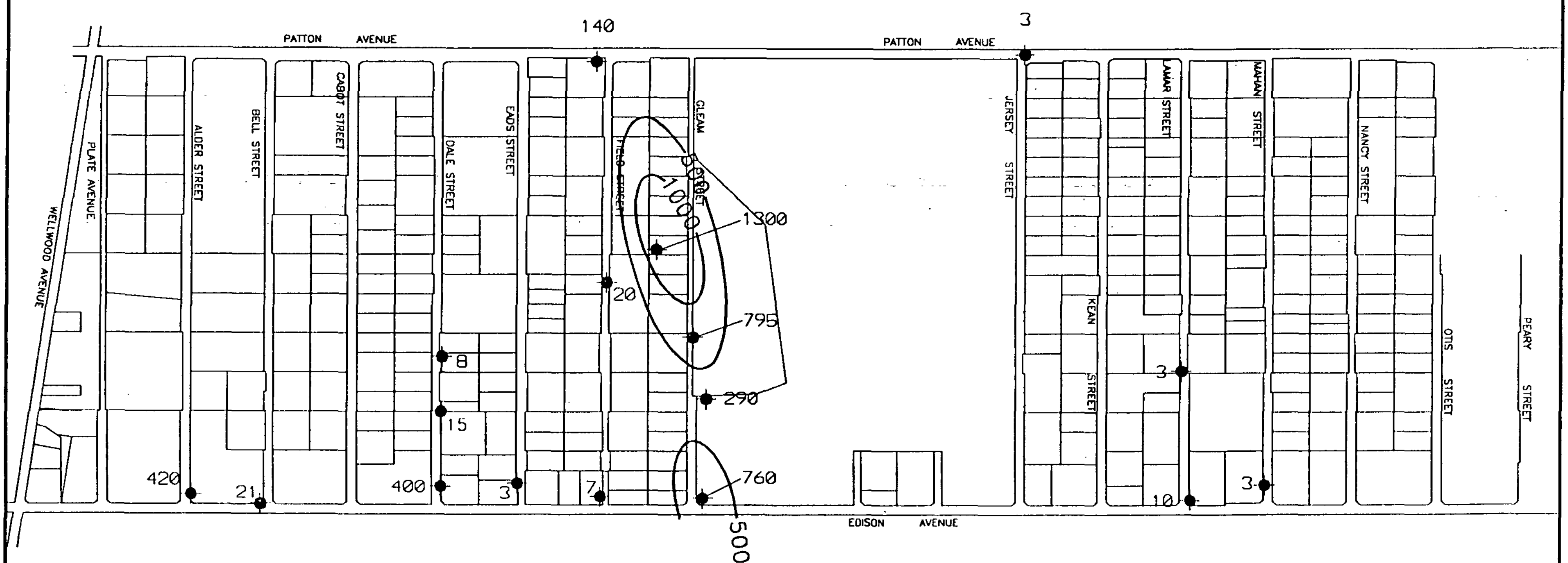
ENGINEERING-SCIENCE
BABYLON, NEW YORK
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-23

001631ID\SY274\SY274002.DWG | REVISED 7/7/92

# PCE CONCENTRATION IN MIDDLE ZONE




LEGEND

BORING LOCATIONS

3 CONCENTRATION IN $\mu g/l$

—500— CONTOUR INTERVAL EQUALS 500 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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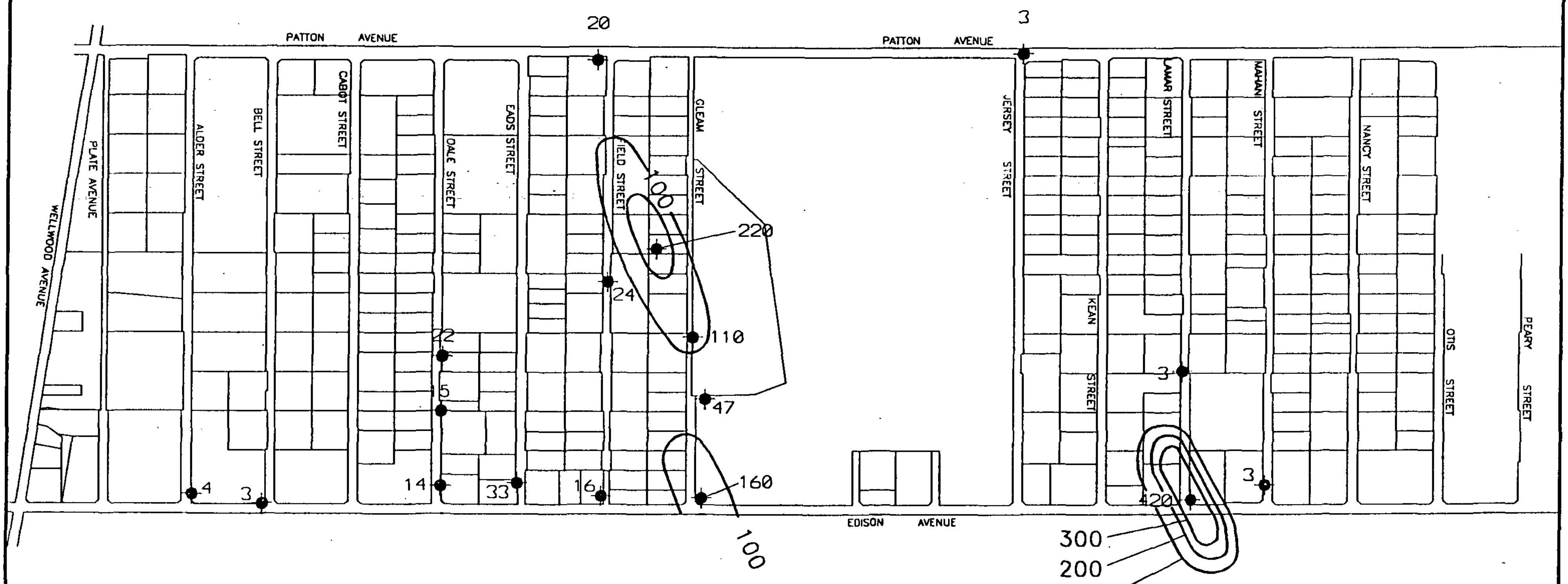
BABYLON, NEW YORK
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-24

001631ID\SY274\SY274002.DWG | REVISED 7/7/92

# TCE CONCENTRATION IN MIDDLE ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —100— CONTOUR INTERVAL EQUALS 100 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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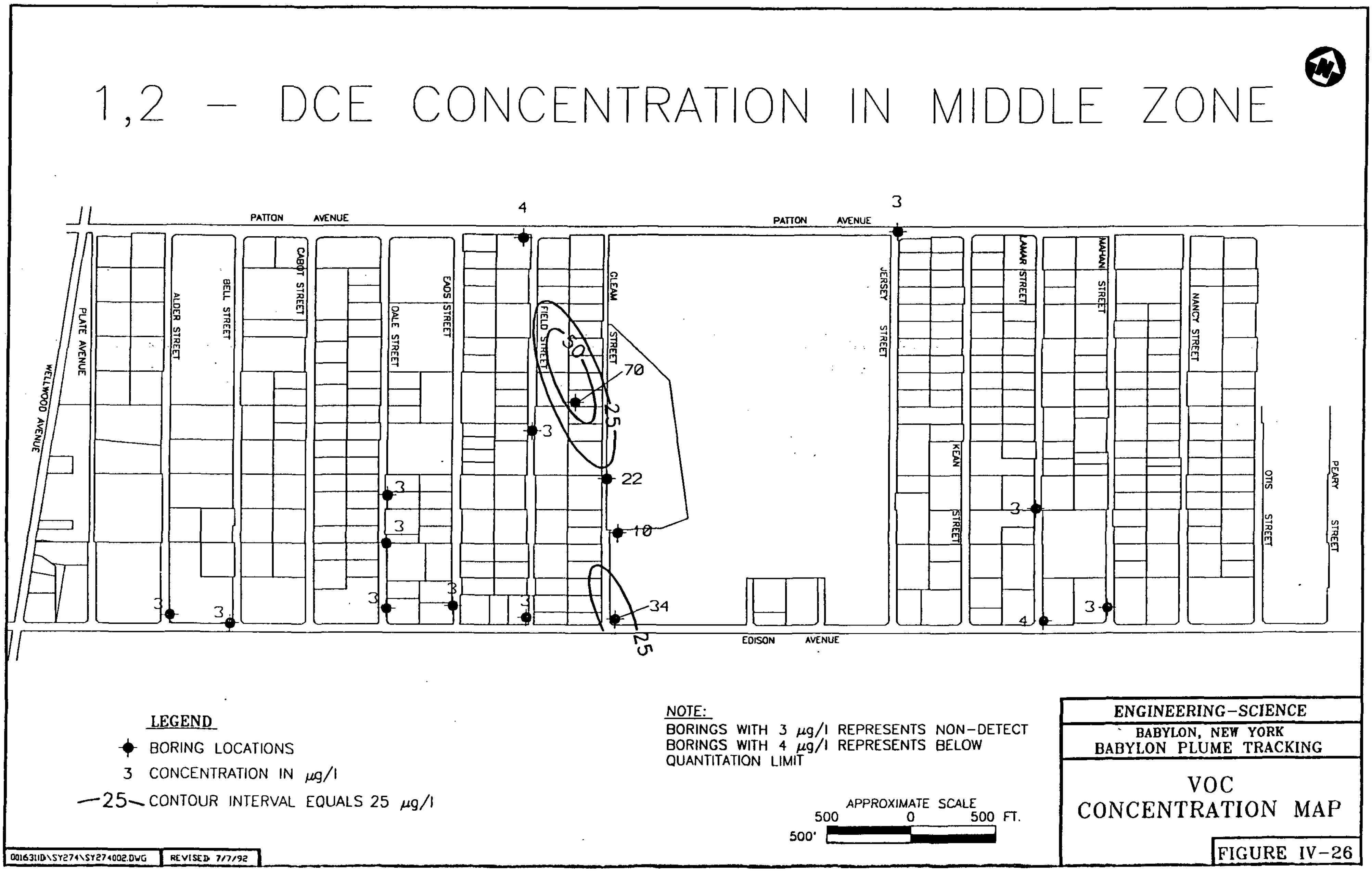
VOC CONCENTRATION MAP

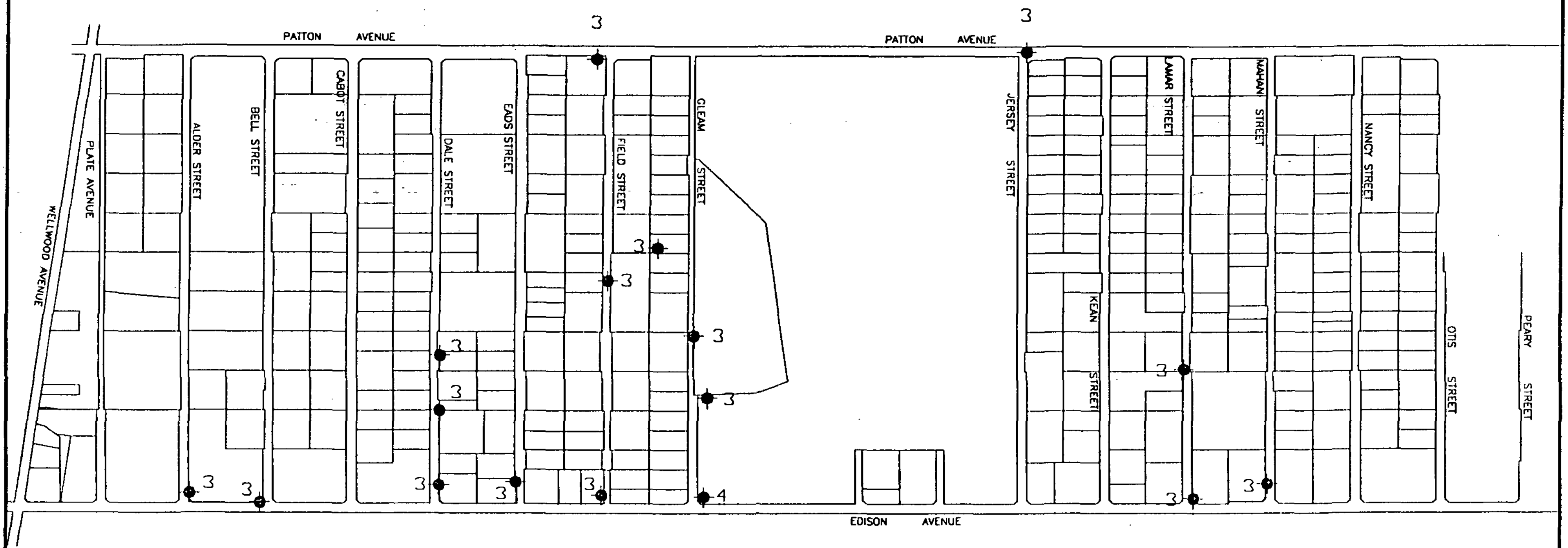
FIGURE IV-25

001631ID\SY274\SY274002.DWG | REVISED 7/7/92



1,2 - DCE CONCENTRATION IN MIDDLE ZONE
PATTON AVENUE
PATTON AVENUE
EDISON AVENUE
WELLWOOD AVENUE
PLATE AVENUE
ALDER STREET
BELL STREET
CABOT STREET
DALE STREET
EAOS STREET
FIELD STREET
GLEAM STREET
JERSEY STREET
KEAN STREET
LAMAR STREET
NAHAN STREET
NANCY STREET
OTIS STREET
PEARY STREET
4
3
50
70
25
3
22
10
34
25
LEGEND
BORING LOCATIONS
3 CONCENTRATION IN µg/l
25 CONTOUR INTERVAL EQUALS 25 µg/l
NOTE:
BORINGS WITH 3 µg/l REPRESENTS NON-DETECT
BORINGS WITH 4 µg/l REPRESENTS BELOW QUANTITATION LIMIT
APPROXIMATE SCALE
500 0 500 FT.
500'
ENGINEERING-SCIENCE
BABYLON, NEW YORK
BABYLON PLUME TRACKING
VOC CONCENTRATION MAP
FIGURE IV-26
001631ID\SY274\SY274002.DWG
REVISED 7/7/92

# 1,1 – DCE CONCENTRATION IN MIDDLE ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

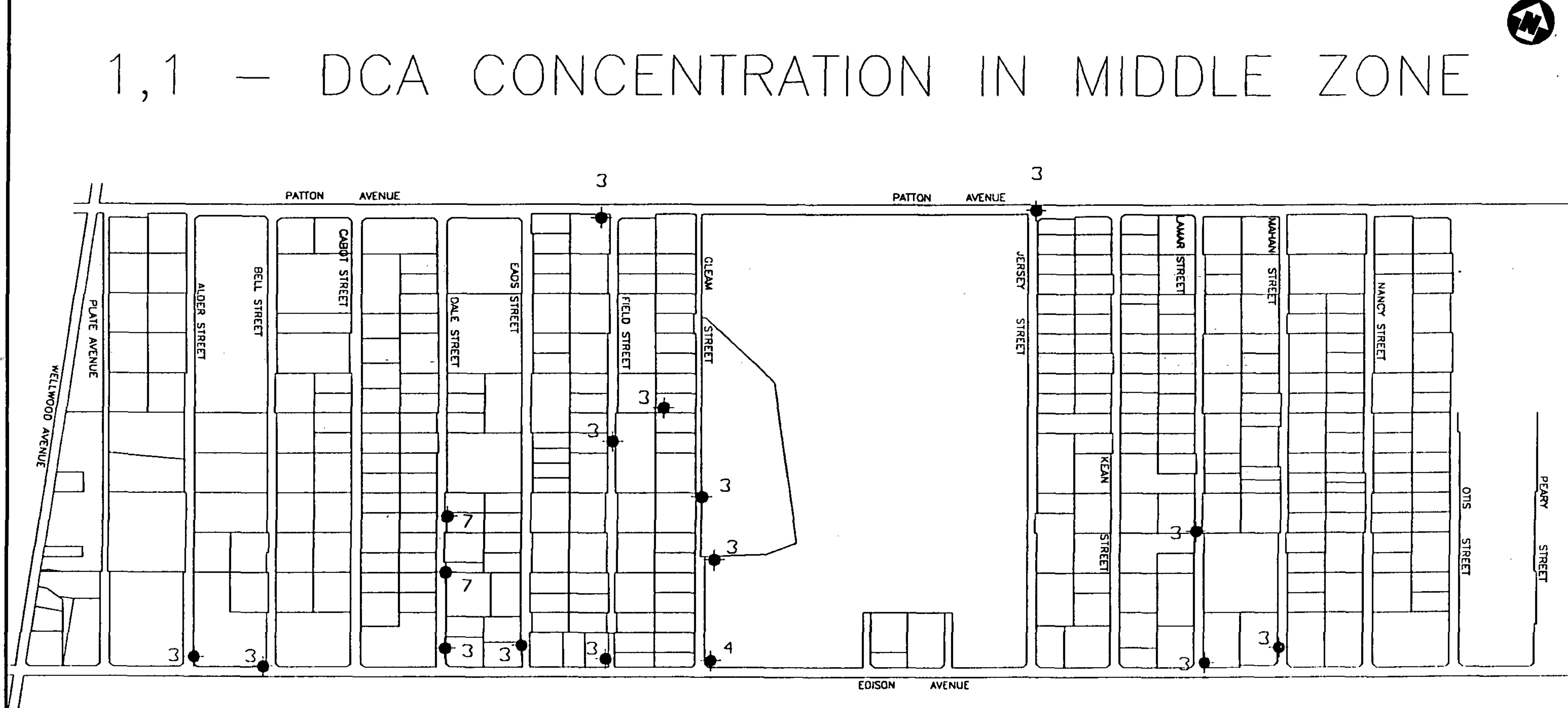
ENGINEERING-SCIENCE
BABYLON, NEW YORK
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-27

001631ID:\SY274\SY274002.DWG | REVISED: 7/7/92

# 1,1 – DCA CONCENTRATION IN MIDDLE ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN ~~ppb~~ µg/l

NOTE:
BORINGS WITH 3 µg/l REPRESENTS NON-DETECT
BORINGS WITH 4 µg/l REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

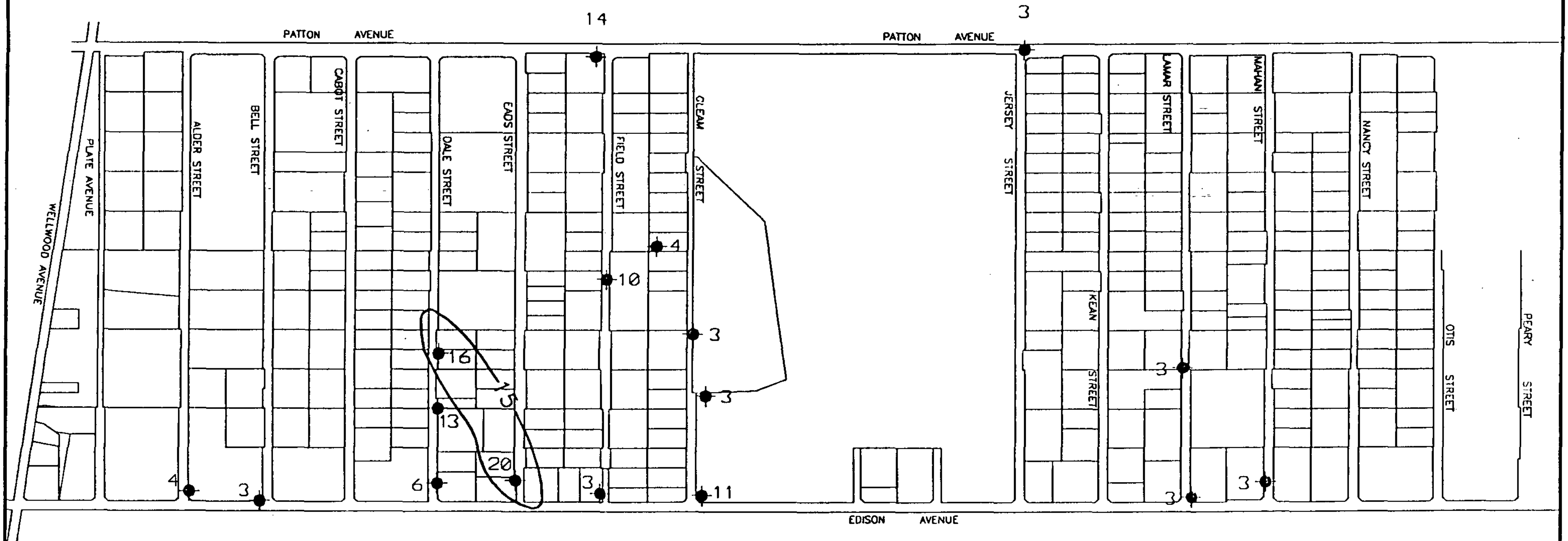
ENGINEERING-SCIENCE
BABYLON, NEW YORK
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-28

001631ID\SY274\SY274002.DWG | REVISED 7/7/92

# 1,1,1 – TCA CONCENTRATION IN MIDDLE ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN μg/l
- —15— CONTOUR INTERVAL EQUALS 15 μg/l

NOTE:
BORINGS WITH 3 μg/l REPRESENTS NON-DETECT
BORINGS WITH 4 μg/l REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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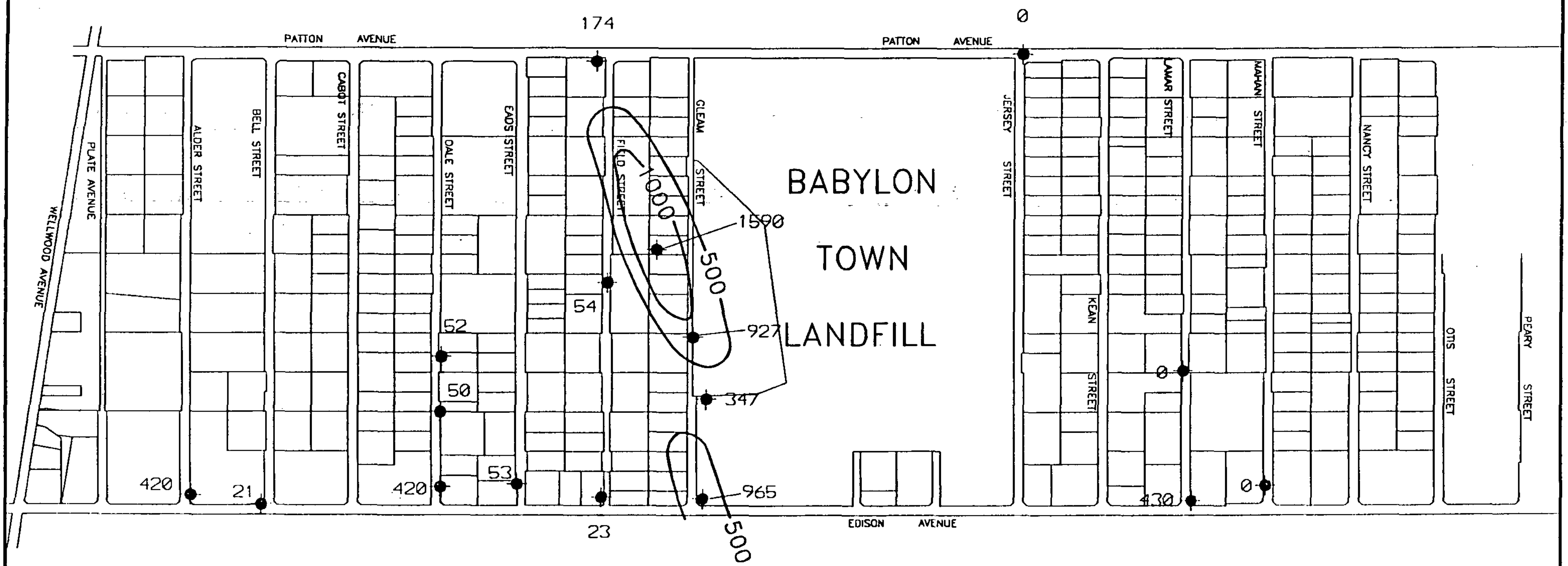
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-29

001631ID\SY274\SY274002.DWG | REVISED: 7/7/92

# TOTAL CHLORINATED ORGANICS
# CONCENTRATION IN MIDDLE ZONE




**LEGEND**

BORING LOCATIONS

3 CONCENTRATION IN μg/l

—100— CONTOUR INTERVAL EQUALS 300 μg/l

NOTE:

BORINGS WITH 3 μg/l REPRESENTS NON-DETECT
BORINGS WITH 4 μg/l REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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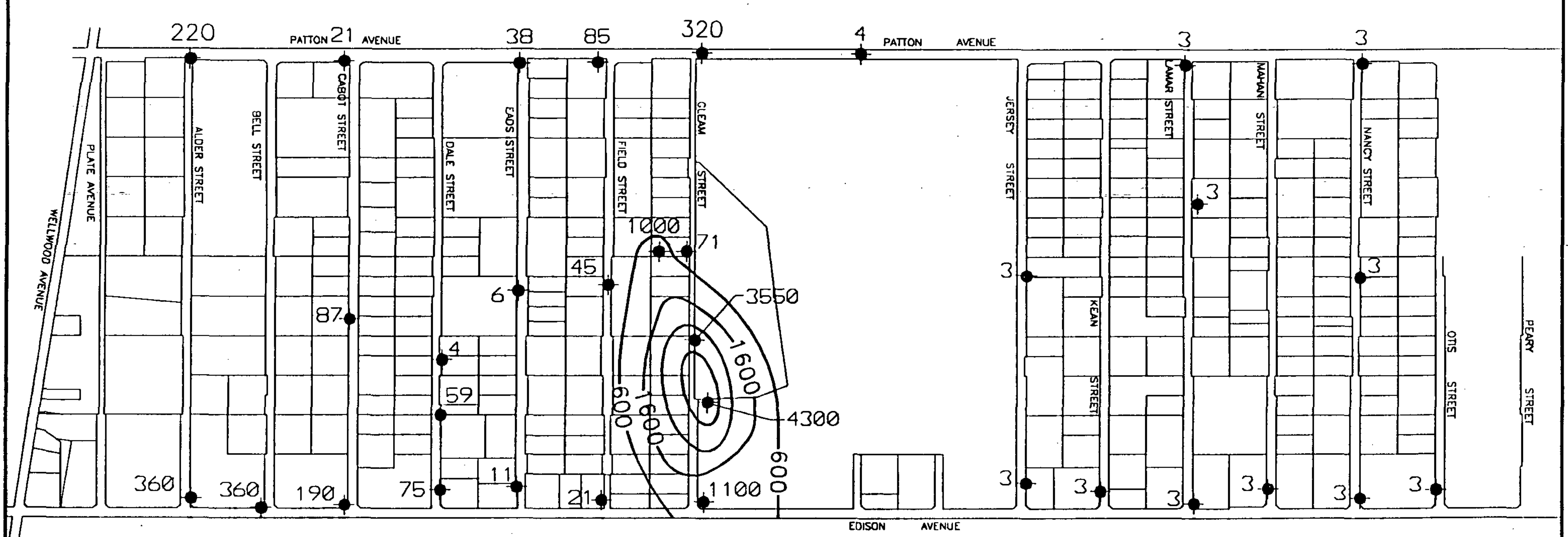
BABYLON PLUME TRACKING

VOC
CONCENTRATION MAP

FIGURE IV-30

00163110\SY274\SY274002.DWG | REVISED: 7/7/92

# PCE CONCENTRATION IN DEEP ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- — 600 — CONTOUR INTERVAL EQUALS 1000 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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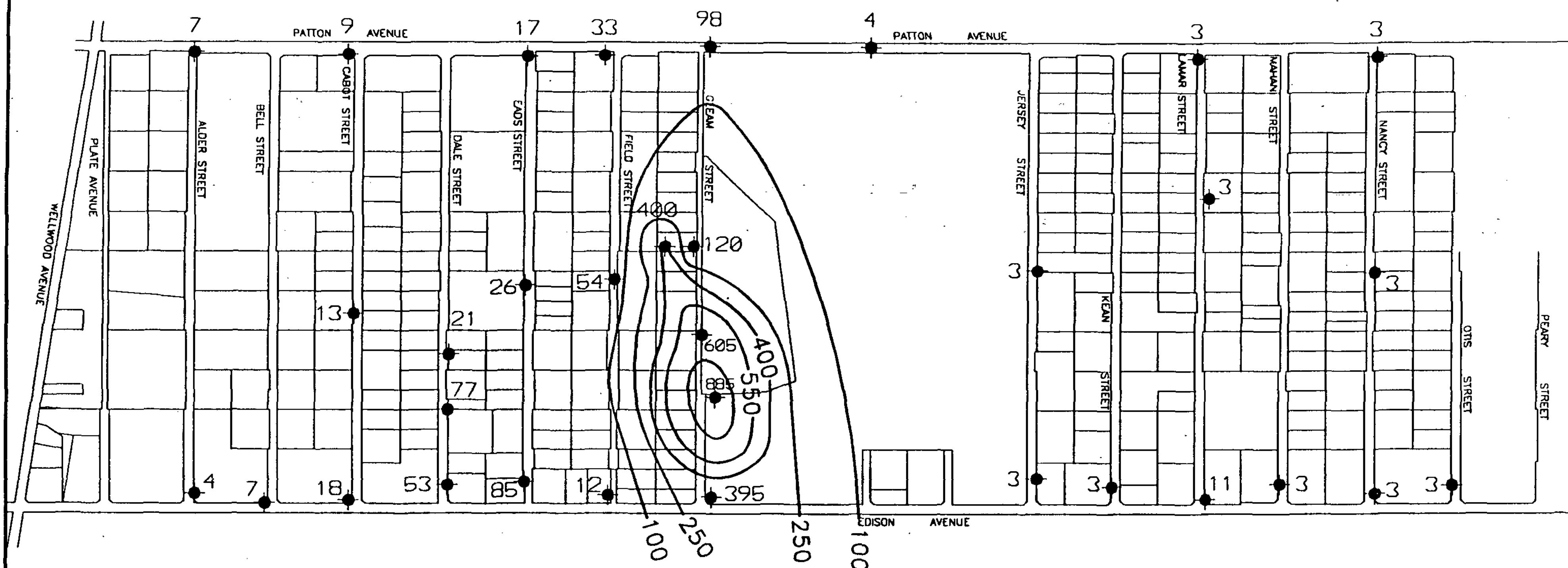
VOC CONCENTRATION MAP

FIGURE IV-31

00163110\SY274\SY274002.DWG | REVISED 9/2/92

# TCE CONCENTRATION IN DEEP ZONE




LEGEND

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —100— CONTOUR INTERVAL EQUALS 150 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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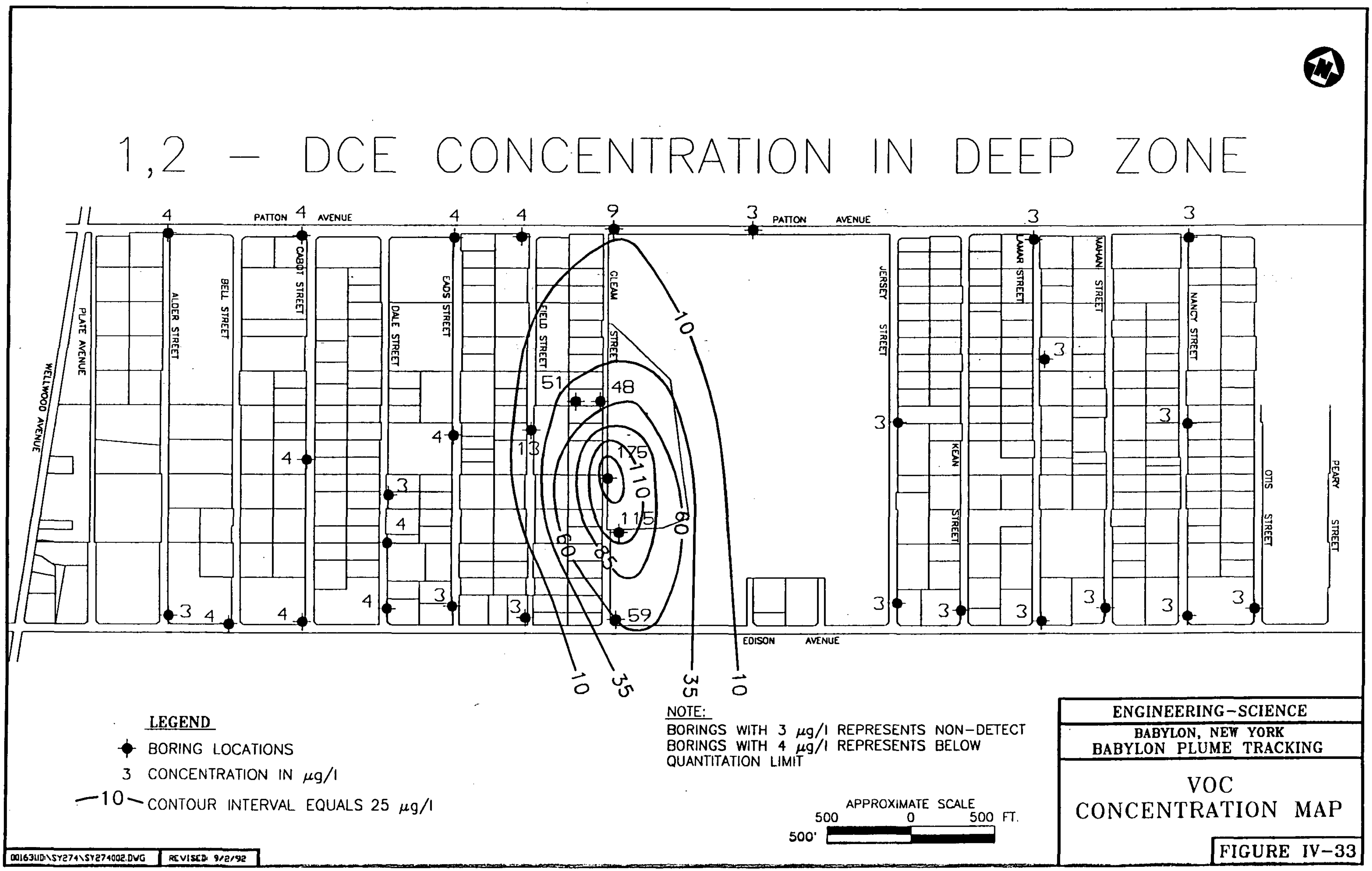
BABYLON PLUME TRACKING

VOC
CONCENTRATION MAP

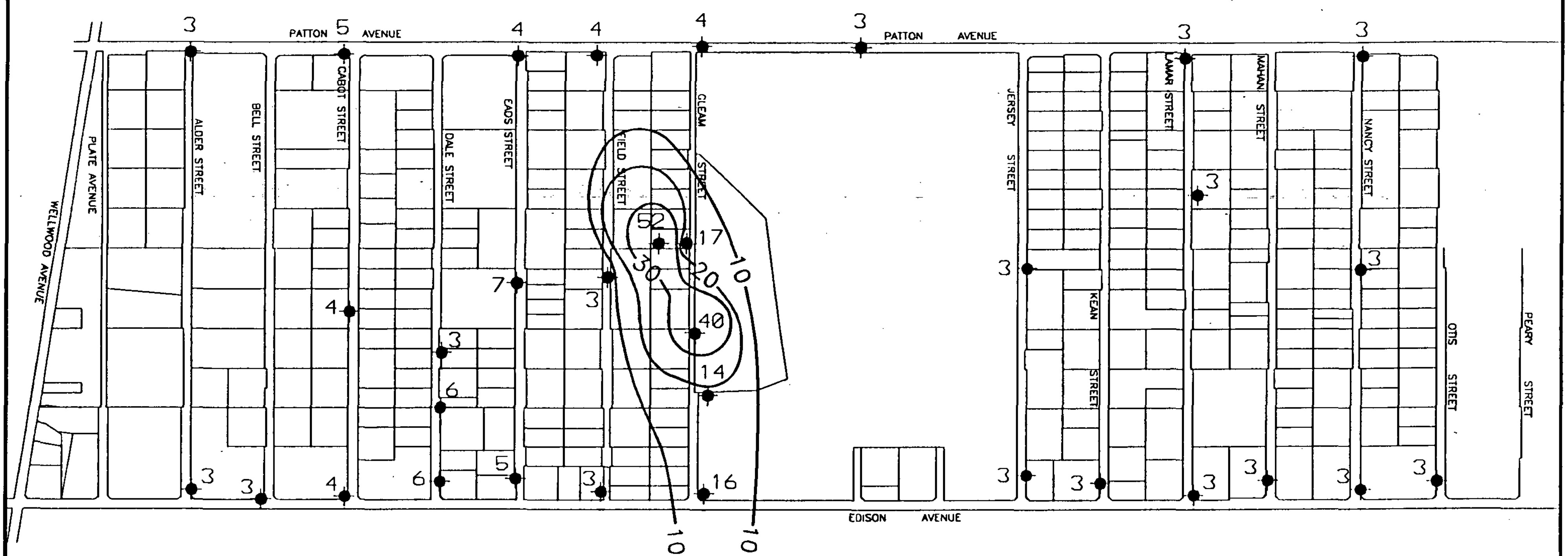
FIGURE IV-32

001631ID\SY274\SY274002.DWG | REVISED 9/2/92



1,2 - DCE CONCENTRATION IN DEEP ZONE
PATTON AVENUE
EDISON AVENUE
WELLWOOD AVENUE
PLATE AVENUE
ALDER STREET
BELL STREET
CABOT STREET
DALE STREET
EADS STREET
FIELD STREET
GLEAM STREET
JERSEY STREET
KEAN STREET
LAMAR STREET
MAHAN STREET
NANCY STREET
OTIS STREET
PEARY STREET
LEGEND
BORING LOCATIONS
3 CONCENTRATION IN µg/l
10 CONTOUR INTERVAL EQUALS 25 µg/l
NOTE:
BORINGS WITH 3 µg/l REPRESENTS NON-DETECT
BORINGS WITH 4 µg/l REPRESENTS BELOW QUANTITATION LIMIT
APPROXIMATE SCALE
500 0 500 FT.
500'
ENGINEERING-SCIENCE
BABYLON, NEW YORK
BABYLON PLUME TRACKING
VOC CONCENTRATION MAP
FIGURE IV-33
00163UD\SY274\SY274002.DWG
REVISED: 9/2/92

# 1,1 - DCE CONCENTRATION IN DEEP ZONE




**LEGEND**

- BORING LOCATIONS

3 CONCENTRATION IN $\mu g/l$

—10— CONTOUR INTERVAL EQUALS 10 $\mu g/l$

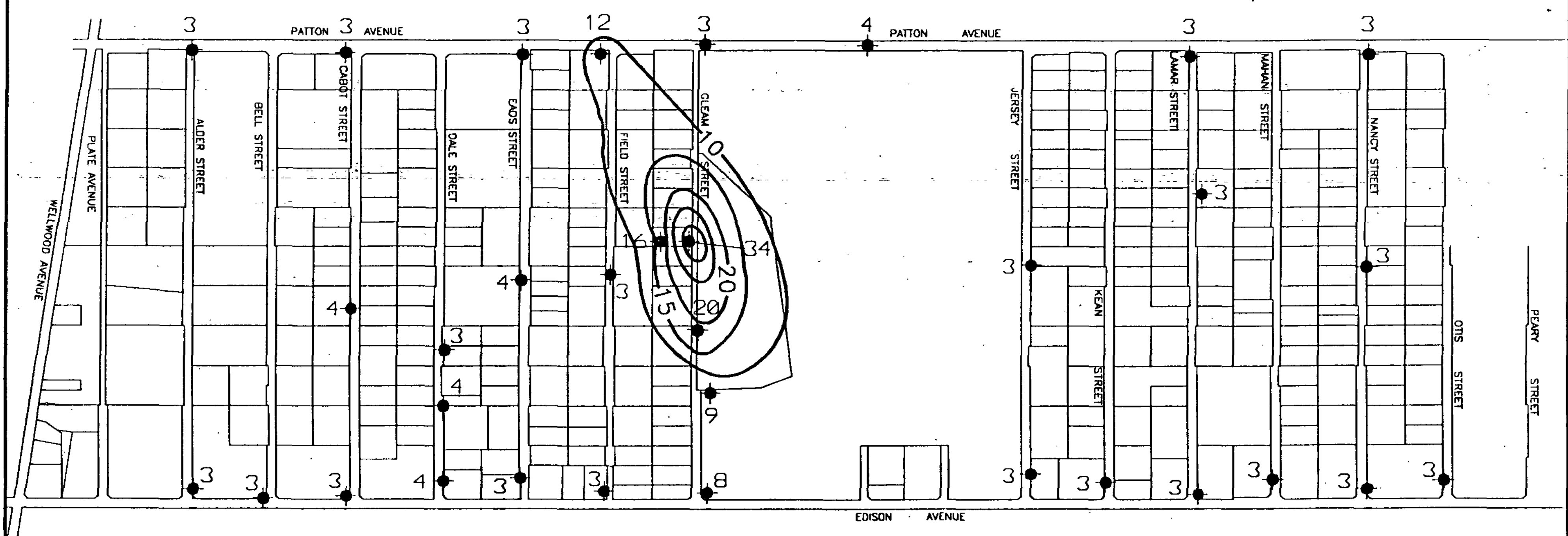
NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

| |
|---|
| ENGINEERING-SCIENCE |
| BABYLON, NEW YORK<br>BABYLON PLUME TRACKING |
| VOC<br>CONCENTRATION MAP |
| FIGURE IV-34 |

00163110\SY274\SY274002.DWG | REVISED 9/2/92

# 1,1 - DCA CONCENTRATION IN DEEP ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN μg/l
- —10— CONTOUR INTERVAL EQUALS 5 μg/l

NOTE:
BORINGS WITH 3 μg/l REPRESENTS NON-DETECT
BORINGS WITH 4 μg/l REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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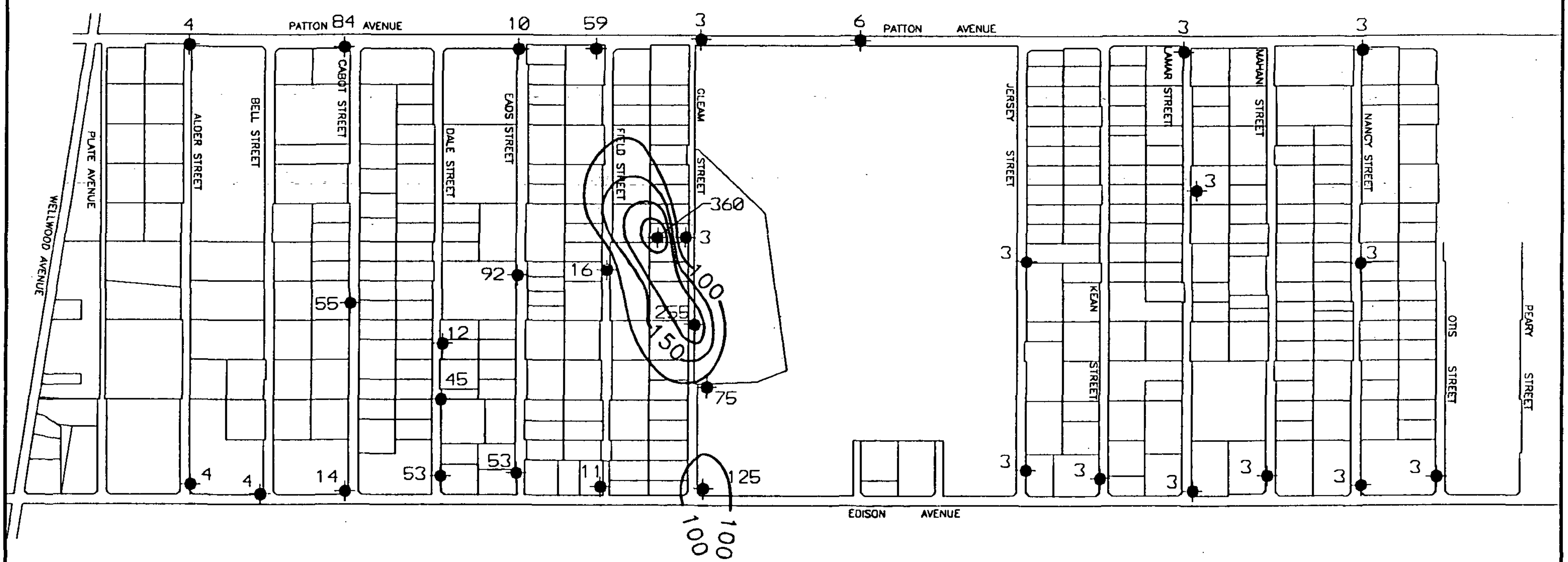
VOC CONCENTRATION MAP

FIGURE IV-35

00163110\SY274\SY274002.DWG | REVISED: 9/2/92

# 1,1,1 – TCA CONCENTRATION IN DEEP ZONE




**LEGEND**

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —100— CONTOUR INTERVAL EQUALS 50 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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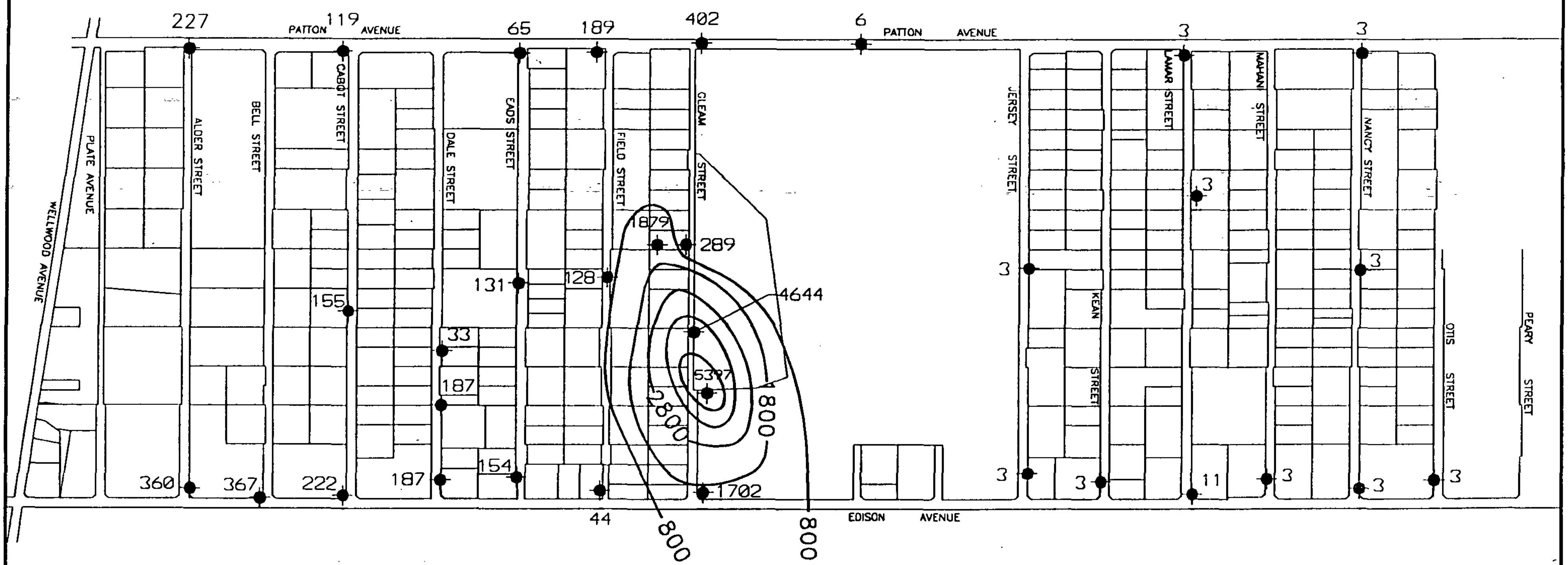
VOC CONCENTRATION MAP

FIGURE IV-36

00163110\SY274\SY274002.DWG | REVISED: 9/2/92

# TOTAL CHLORINATED ORGANICS CONCENTRATION IN DEEP ZONE




## LEGEND

- BORING LOCATIONS
- 3 CONCENTRATION IN $\mu g/l$
- —800— CONTOUR INTERVAL EQUALS 1000 $\mu g/l$

NOTE:
BORINGS WITH 3 $\mu g/l$ REPRESENTS NON-DETECT
BORINGS WITH 4 $\mu g/l$ REPRESENTS BELOW QUANTITATION LIMIT

APPROXIMATE SCALE
500 0 500 FT.
500'

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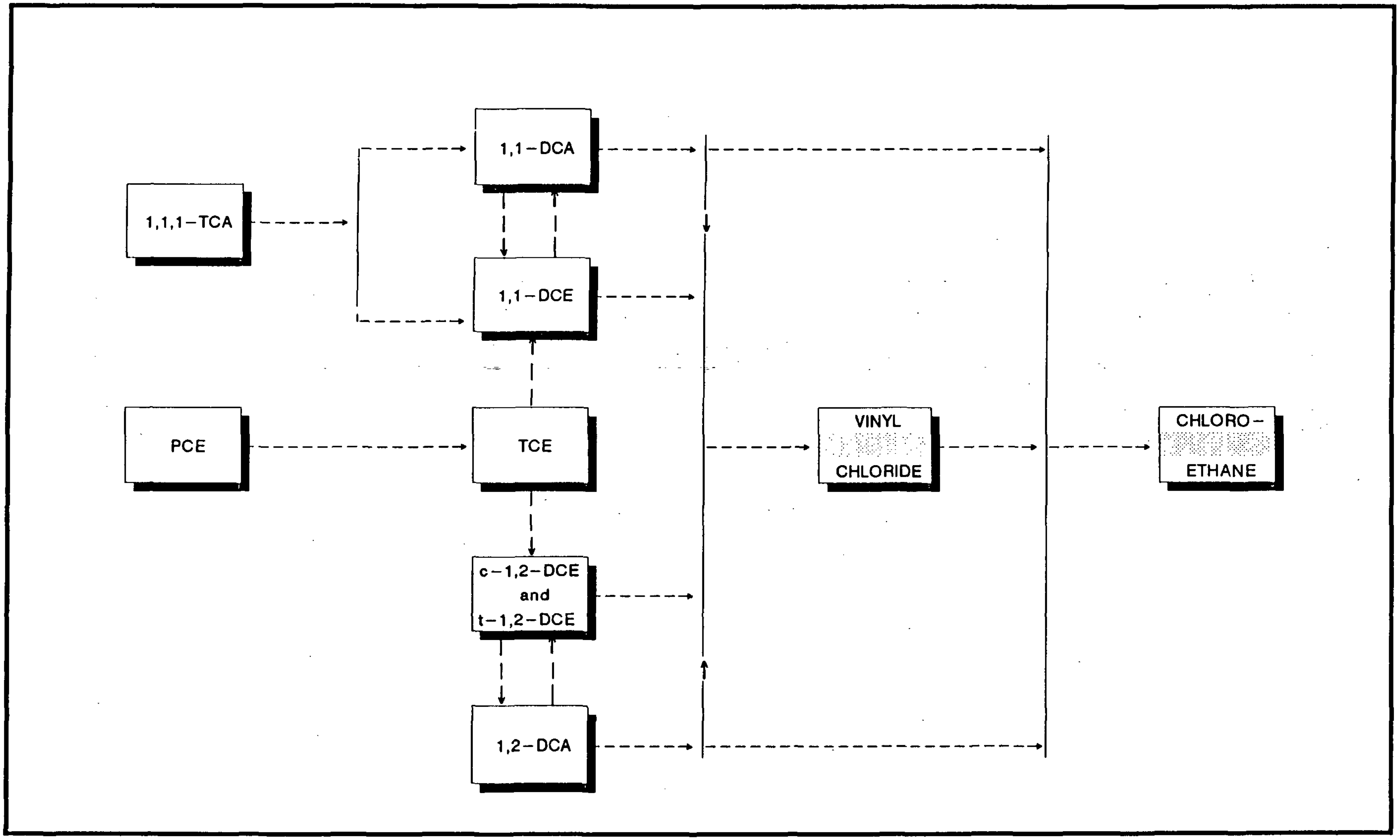
BABYLON PLUME TRACKING

VOC CONCENTRATION MAP

FIGURE IV-37

001631ID\SY274\SY274002.DWG | REVISED 7/7/92

## FIGURE IV-38 – TRANSFORMATION PATHWAYS FOR CHLORINATED HYDROCARBONS




SOURCE: DRAGUN, 1988
PRINTED ON: 06/26/92
PRINTED AT: 05:44 PM
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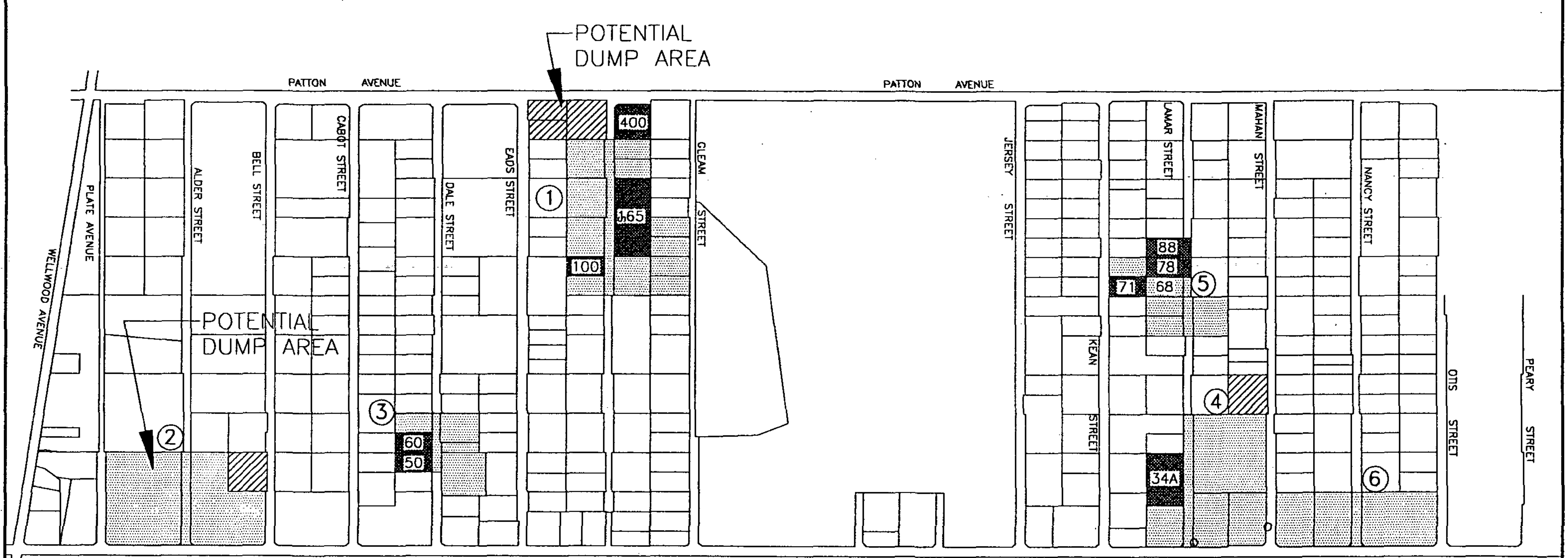


**LEGEND**

POTENTIAL VOC SOURCE AREAS

RECHARGE BASIN

88 POTENTIAL VOC SOURCE AREAS WITH SUPPORTING EVIDENCE FROM HISTORICAL RECORDS SEARCH

78 STREET ADDRESS

2 PLUME/SOURCE NUMBER

APPROXIMATE SCALE
500 0 500 FT.
500'

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POTENTIAL SOURCE AREAS FOR VOC CONTAMINATION ZONES

FIGURE IV-39

:163UD\SY274\SY274002.DWG REVISED: 9/15/92

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